

W-13-300

A UNITED STATES  
DEPARTMENT OF  
COMMERCE  
PUBLICATION



# NBS TECHNICAL NOTE 625

## Computer Programs for Thermodynamic and Transport Properties of Hydrogen (Tabcode-II)

(NASA-CR-129261) COMPUTER PROGRAMS FOR  
THERMODYNAMIC AND TRANSPORT PROPERTIES OF  
HYDROGEN (TABCODE-II) H.M. Roder, et al  
(National Bureau of Standards) Oct. 1972  
227 p

N73-12959

CSCL 20M G3/33 Unclass  
48218

U. S.  
DEPARTMENT  
OF  
COMMERCE

National  
Bureau  
of  
Standards

PRECEDING PAGE BLANK NOT FILMED

CONTENTS

	Page
1. Introduction . . . . .	1
1.1 Symbols and Units Used . . . . .	2
2. Hydrogen Modifications, Property Differences, and Phase Diagrams . . . . .	4
2.1 Hydrogen Modifications . . . . .	4
2.2 Property Differences . . . . .	5
2.3 Range of the Programs and Phase Diagrams . . . . .	6
2.4 The Phase Designator, Q . . . . .	8
3. Overview of the Programs . . . . .	9
3.1 Method Used . . . . .	10
3.2 Peculiarities of the P-T Programs . . . . .	10
3.3 Peculiarities of the P-H Programs . . . . .	10
3.4 The Saturation Routines . . . . .	11
4. Programming Information . . . . .	12
4.1 Deck Description . . . . .	12
4.2 Calling Sequence . . . . .	15
4.3 Exceeding the Range of the Programs . . . . .	16
4.4 Conversion to Other Systems or Installations . . . . .	16
4.5 Pitfalls, Common Errors in Applications . . . . .	17
4.6 Debugging Aids . . . . .	17
5. Structural Details of the Programs . . . . .	13
5.1 Grid and Region Layout . . . . .	18
5.2 Speed . . . . .	20
5.3 Continuous Functions . . . . .	20
5.4 Modifications, Future Developments . . . . .	21
6. Estimation of Errors . . . . .	22
7. Sources of Properties Data . . . . .	24
7.1 Ideal Gas Properties . . . . .	24
7.2 The PVT Surface at Low Temperatures . . . . .	26
7.3 The PVT Surface at Intermediate Temperatures . . . . .	26
7.4 The PVT Extrapolation . . . . .	27
7.5 Dissociation . . . . .	29
7.6 Viscosity . . . . .	30
7.7 Thermal Conductivity . . . . .	31
7.8 Generating Functions . . . . .	33
8. References . . . . .	34

	Page
Appendix A. Tables of Values for Selected Isobars . . . . .	37
Appendix B. Program Listings: CDC and IBM . . . . .	52
Appendix C. Plots of Maximum Interpolation Error and Estimated Source Error . . . . .	177

#### LIST OF TABLES

1. Values of the Phase Designator, Q . . . . .	8
2. List of Available Program Decks . . . . .	9
3. Returns from the Liquid-Vapor Two Phase Region . . . . .	12
4. Deck Description, p-hydrogen . . . . .	13
5. Deck Description, e-hydrogen . . . . .	14
6. Low Temperature Error Grid, Pressures, psia . . . . .	23
7. Low Temperature Error Grid, Temperature, °R . . . . .	24
8. Coefficients of the Equation of State . . . . .	27
9. Generating Functions . . . . .	33

#### LIST OF FIGURES

1. Hydrogen Composition at Equilibrium . . . . .	4
2. Ideal Gas Specific Heat of Para and Equilibrium Hydrogen . . . . .	6
3. The P-T Phase Diagram for Hydrogen . . . . .	7
4. The P-H Phase Diagram for Parahydrogen . . . . .	7
5. Region Layout for $C_p$ with Entry Variables P-H, p-hydrogen . . . . .	18
6. Partial Grid Layout for Program PTENTH . . . . .	19
7. Matching of Values at Boundaries . . . . .	21
8. Primary Sources of Data . . . . .	25
9. Comparison of PVT and Derived Properties . . . . .	28
10. The Effect of Dissociation on Enthalpy . . . . .	30
11. The Viscosity of Dissociating Hydrogen at Various Pressures . . . . .	31
12. The Thermal Conductivity of Dissociating Hydrogen at Various Pressures . . . . .	32

COMPUTER PROGRAMS FOR THERMODYNAMIC  
AND TRANSPORT PROPERTIES OF HYDROGEN  
(Tabcode-II)

H. M. Rodsr, R. D. McCarty, and W. J. Hall

The thermodynamic and transport properties of para and equilibrium hydrogen have been programmed into a series of computer routines. Input variables are the pair's pressure-temperature and pressure-enthalpy. The programs cover the range from 1 to 5000 psia ( $34 \text{ MN/m}^2$ ) with temperatures from the triple point to  $6000^\circ\text{R}$  ( $3300 \text{ K}$ ) or enthalpies from  $-130 \text{ BTU/lb}$  ( $-623 \text{ J/mol}$ ) to  $25,000 \text{ BTU/lb}$  ( $117000 \text{ J/mol}$ ). Output variables are enthalpy or temperature, density, entropy, thermal conductivity, viscosity, velocity of sound, heat capacity at constant pressure, heat capacity at constant volume, the heat capacity ratio, and a heat transfer parameter. Property values on the liquid and vapor boundaries are conveniently obtained through two small routines. The programs achieve high speed by using linear interpolation in a grid of precomputed points which define the surface of the property returned. The maximum errors arising from the linear interpolation are shown on individual deviation plots for each combination of variables. Error estimates for the sources of data are similarly displayed.

**Key Words:** Computer programs; density; enthalpy; entropy; heat capacity at constant pressure; heat capacity at constant volume; heat capacity ratio; heat transfer coefficient; hydrogen; pressure; saturation boundary; temperature; thermal conductivity; velocity of sound; viscosity.

## 1. INTRODUCTION

Extensive use of hydrogen in the chemical industry and as a propellant in the U. S. space program requires that the engineer be provided values of thermodynamic and transport properties of this fluid in useful form. In many problems the properties have to be evaluated at numerous thermodynamic state points. The problems are often handled on a computer and they involve iterative computational methods. In the present report we describe a series of computer routines which are fast, moderately accurate, and operate over wide ranges of input variables. They are based on selected source data. The input (entry) and output (returned) variables are:

Input	Output	Input	Output
pressure- temperature	enthalpy density entropy thermal conductivity viscosity velocity of sound heat capacity, $C_p$ heat capacity, $C_v$ heat capacity ratio heat transfer parameter	pressure- enthalpy	temperature, and phase or state density entropy thermal conductivity viscosity velocity of sound heat capacity, $C_p$ heat capacity, $C_v$ heat capacity ratio heat transfer parameter



In addition there are two small saturation routines which return values on the saturation boundaries. The computer routines were developed primarily for nuclear rocket engine design. The programs cover a wide range of conditions as follows: for temperatures from the triple point ( $24.845^{\circ}\text{R}$ ,  $13.803\text{ K}$ ) to about  $6000^{\circ}\text{R}$  ( $3300\text{ K}$ ), for pressures from 1 to 5000 psia ( $34\text{ MN/m}^2$ ), and for enthalpies from -130 to 25,000 BTU/lb ( $-623$  to  $117000\text{ J/mol}$ ). In addition, the thermodynamic and transport properties of both para hydrogen and equilibrium hydrogen are available through these programs. An important criterion for many applications is computational speed, as some process control calculations have to be made in real time. The linear interpolation employed achieves speed but sacrifices accuracy. As an aid to the user, we have determined the maximum error due to the interpolation scheme and estimated the error in the source data. These errors are displayed in departure graphs for each program.

An older version of the para hydrogen programs, which has been distributed widely, should now be considered obsolete (Tabcode-I, Hall, et al., 1967, and McCarty 1968). The changes and improvements over the older version are as follows:

1. The temperature range has been extended to  $6000^{\circ}\text{R}$ , the enthalpy range to 25,000 BTU/lb.
2. New measurements of thermal conductivity between  $30^{\circ}$  and  $275^{\circ}\text{R}$  are now included.
3. Improved values for both thermal conductivity and viscosity have been inserted for temperatures above  $1200^{\circ}\text{R}$ .
4. The saturation subroutines are now included in the package.
5. For equilibrium hydrogen, which was not treated previously, an entire set of programs is now provided.
6. A combination of variables is now included which describe a commonly used heat transfer parameter, designated herein as L-factor (see Section 1.1).

The main divisions of the report are text, program listings, and error graphs. The text contains all the normal description given for computer programs such as deck size, calling sequence, etc. However, for this problem the selection of source data and the computation of the property values placed in data arrays are important; they are, therefore, described in some detail.

### 1.1 Symbols and Units Used

The programs were developed for engineering applications; therefore, the units of this report are those commonly used in engineering, i.e., psia, BTU, etc. The sources of data, however, normally employ some version of metric units. In the discussion of the equation of state, the virial B, and in figures 11 and 12, the units of the original sources had to be retained. Conversion factors for changes from source papers to generating functions to the present program have all been taken from NASA Special Publication 7012 (Mechtly 1969).

P	pressure, psia
T	temperature, °R
H	enthalpy, BTU/lb
$H_{\text{gas}}$	enthalpy of saturated vapor, BTU/lb
$H_{\text{liquid}}$	enthalpy of saturated liquid, BTU/lb
S	entropy, BTU/lb - °R
$\rho$	density, lb/ft <sup>3</sup>
$C_p$	specific heat at constant pressure, BTU/lb - °R
$C_v$	specific heat at constant volume, BTU/lb - °R
$\gamma$	the ratio $C_p/C_v$ , dimensionless
$w$	sound velocity, ft/s
$\eta$	viscosity, lb-h/ft <sup>2</sup>
k	thermal conductivity BTU/h-ft - °R
L	a heat transfer parameter equal to $k^{0.6} C_p^{0.4} / \eta^{0.4}$ , with units as shown above. [This heat transfer parameter is the combination of thermal properties occurring in the conventional Dittus-Boelter (Nusselt type) equation describing the forced convection heat transfer coefficient for turbulent flow (see, for example, equation 9-10a, page 219, McAdams 1954)].
Q	the phase designator, dimensionless

Additional symbols used in text:

B or B(T)	the second virial coefficient
$E_0^\circ$	ideal gas internal energy at absolute zero, the reference state, taken to be zero
$\pi$	general symbol for property
$P_c$	critical pressure
R	gas constant
RE	general symbol for the return from the liquid-vapor two phase region
superscript °	ideal gas thermodynamic properties, i.e., $C_p^\circ$ , $C_v^\circ$ , $H^\circ$
U	internal energy
V	volume
Z	PV/RT

Important state points for para and equilibrium hydrogen:

triple point	normal boiling point	critical point
P = 1.022 psia	P = 14.696 psia	P = 187.506 psia
T = 24.845°R	T = 36.482°R	T = 59.356°R

## 2. HYDROGEN MODIFICATIONS, PROPERTY DIFFERENCES, AND PHASE DIAGRAMS

A brief review of the more important features in the physics of hydrogen is essential if we are to understand what properties the programs return, and why some of the peculiarities of the programs occur.

### 2.1 Hydrogen Modifications

Hydrogen molecules occur in two natural modifications, parahydrogen and orthohydrogen. In the parahydrogen molecule the two nuclear spins are opposed while in orthohydrogen they are aligned. Under normal conditions, the transition probability between states is practically zero; a catalyst, a sharp gradient in magnetic field, or external radiation (e.g., nuclear radiation, x-rays, ultraviolet, etc.) is required to let the transition proceed. Conversion between these two modifications is temperature dependent, as shown in figure 1, which is based on Woolley, et al., (1948). At low temperatures in the presence of an appropriate catalyst, the thermal equilibrium favors the para modification. At the normal boiling point ( $36.482^{\circ}\text{R}$ ), the equilibrium composition is 99.79% para and only 0.21% orthohydrogen. This composition is often simply referred to as parahydrogen or p-hydrogen.

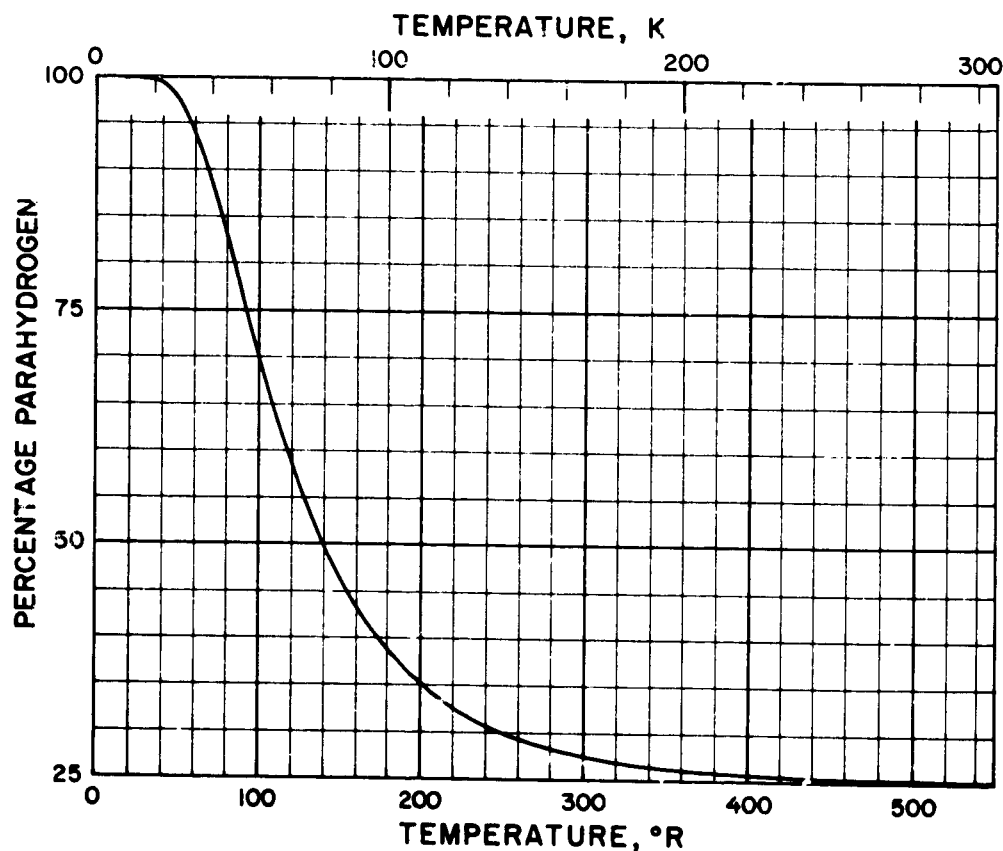


Figure 1. Hydrogen Composition at Equilibrium

Conversely, the equilibrium composition near ambient temperature is 75% ortho and 25% para. This latter composition is usually designated normal or n-hydrogen. When conversion occurs between the normal boiling point and room temperature, then the thermodynamic equilibrium mixture of para and ortho hydrogen is called "equilibrium" or e-hydrogen and the composition at intermediate temperatures varies as shown in figure 1. In this report we describe programs for both p-hydrogen and e-hydrogen.

At temperatures above 2700°R (1500 K) the hydrogen molecule dissociates into hydrogen atoms. This dissociation is both temperature and pressure dependent. Assumptions made in this report are that dissociation occurs according to the equilibrium constant for normal hydrogen, and that the property values can be obtained by adding the dissociation effects calculated for the ideal gas to the extrapolated properties of the real gas.

## 2.2 Property Differences

At comparable state points, property values of the various modifications of hydrogen may differ, that is, some of the properties depend on ortho-para composition. Experimentally these effects are observed in different vapor pressures and in different critical parameters. Most important to this discussion is the fact that the properties of the ideal gas for para and equilibrium hydrogen as calculated from statistical mechanics differ, and further, since the composition change depends only on temperature, that the property differences depend only on temperature. Thus, if a difference exists for an ideal gas property at low pressures, then the same difference exists at all other pressure levels for a given temperature. Stated another way, the statistical calculation, by including the temperature dependent composition change, automatically includes the reaction occurring as para-transforms to equilibrium-hydrogen — i. e., the sensible heat of e-hydrogen includes the appropriate part of the heat of chemical reaction. Not all properties are composition dependent; density and viscosity, for example, are nearly independent of composition. On the other hand, the properties with significant ortho-para dependency are specific heat, and properties related to specific heat such as velocity of sound, entropy, enthalpy, and thermal conductivity. When the properties of p- and e-hydrogen differ, they may differ considerably. For example, the value of enthalpy near the critical point for p-hydrogen is about 16 BTU/lb, whereas the value for equilibrium hydrogen is about 31 BTU/lb. The difference in properties for the ideal gas specific heats,  $C_p^\circ$ , is illustrated in figure 2. Differences for the other properties are best expressed in terms of a table; approximate differences can be obtained by comparing corresponding entries for a pressure of 1 psia in Appendix A (pages 38 and 45).

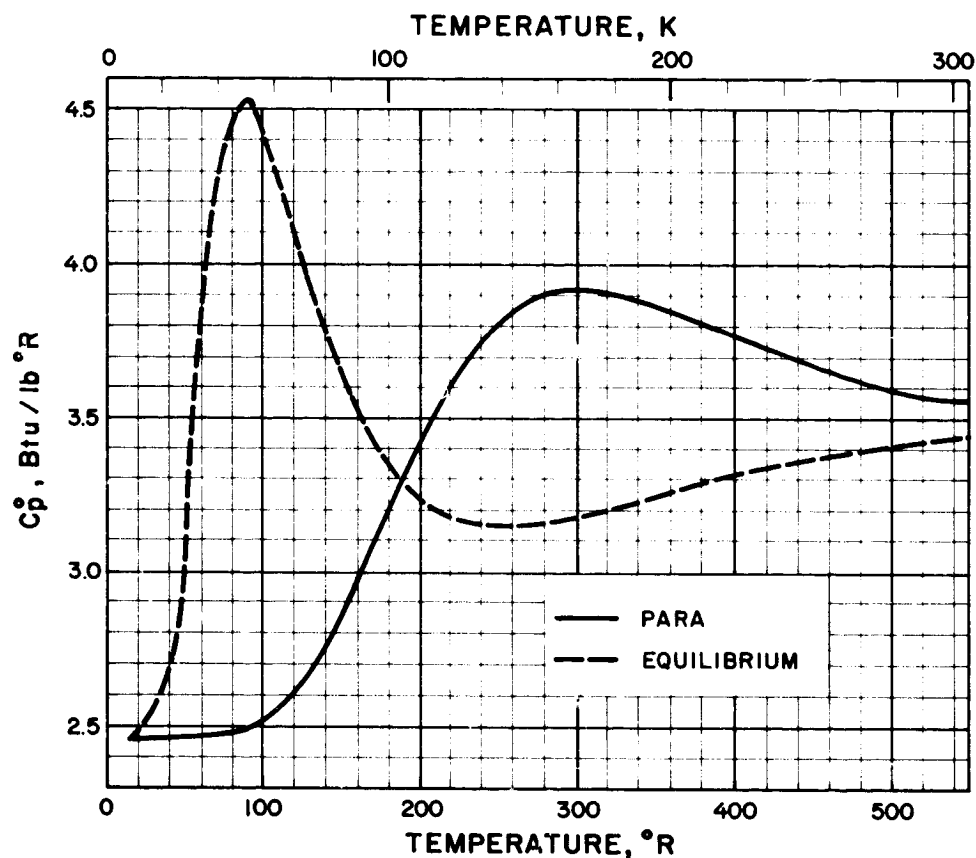


Figure 2. Ideal Gas Specific Heat of Para and Equilibrium Hydrogen

### 2.3 Range of the Programs and Phase Diagrams

For programs which use pressure and temperature as entry variables, the pressure range is 1 to 5000 psia and the temperature range is from the triple point ( $24.845^{\circ}\text{R}$ ) to  $6000^{\circ}\text{R}$ . The P-T range of the programs for both para and equilibrium hydrogen is illustrated by the shaded area in figure 3. The programs cover property values for liquid, gas or vapor states, and dissociation. Note that the programs do not cover the solid phase nor values at pressures less than 1 psia. The low pressure limit is arbitrary; it arises from the behavior of entropy as follows. At any given temperature, the value of entropy approaches infinity as the pressure approaches zero. Since we cannot represent an infinity with linear interpolation between fixed points, a cutoff, 1 psia, was chosen.

For the programs which use pressure and enthalpy as entry variables, the pressure range is the same, 1 psia to 5000 psia. The range of enthalpy is -130 BTU/lb to 25,000 BTU/lb. The enthalpy limits correspond to the enthalpy of the liquid at the triple point, and the ideal gas enthalpy at the highest temperature,  $6000^{\circ}\text{R}$ . The phase diagram of para-hydrogen in pressure-enthalpy coordinates is shown in figure 4. The phase diagram for

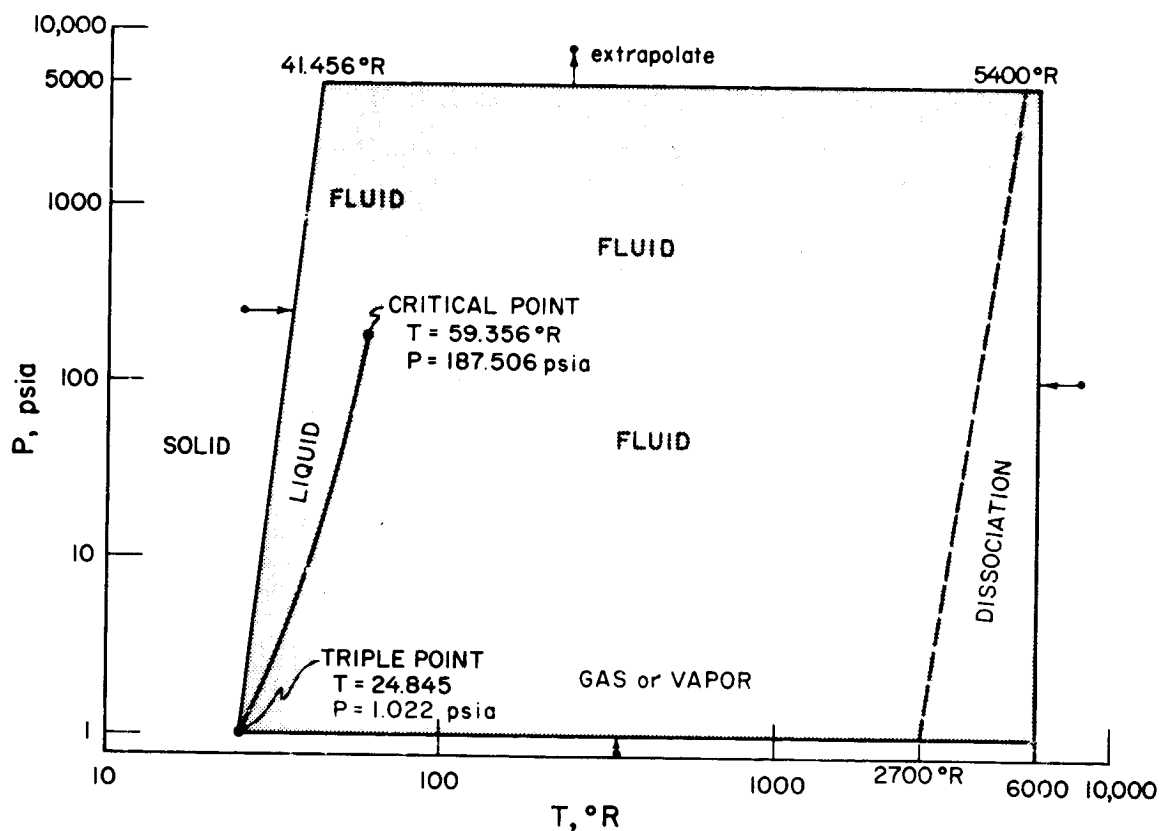


Figure 3. The P-T Phase Diagram for Hydrogen

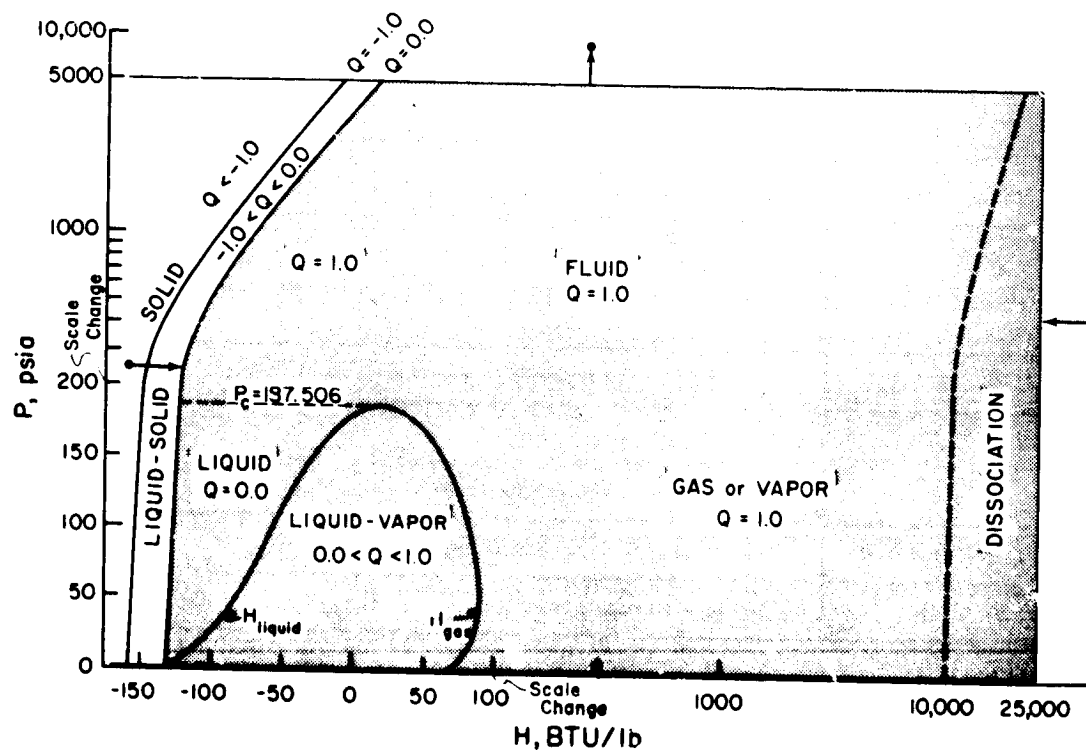


Figure 4. The P-H Phase Diagram for Parahydrogen

e-hydrogen would look quite similar to figure 4 except that the liquid-vapor two phase boundary is gradually displaced to higher values of enthalpy. For example, the enthalpy of e-hydrogen at the critical pressure is about 31 BTU/lb while the maximum value of enthalpy along the two-phase boundary is about 110 BTU/lb. The programs cover property values for liquid, gas or vapor states, and dissociation as before. They do not cover the solid phase, pressures below 1 psia, or the two phase liquid-solid ("slush") conditions.

A comparison of figures 3 and 4 discloses that the conditions, the phases or states of the hydrogen, covered by the P-T and the P-H programs are similar, except that the P-H programs cover the range of states where liquid and gas coexist while the P-T programs do not. A concise designation of the phase or state of any given point is therefore available only by reference to P-H coordinates. Since the description of phase is important in many problems, a scheme to designate the phase was devised and is presented in the next section.

#### 2.4 The Phase Designator, Q

The various physical states possible in the P-H phase diagram are described by the phase designator, Q, available only from program PHTEMP (see also page 11). Values of Q are shown in figure 4 and in table 1. Note that figure 4 includes scale changes at 100 BTU/lb and at 200 psia. For the special case of the two phase liquid-vapor region, Q corresponds to the conventional quality, as defined on page 11.

Table 1. Values of the Phase Designator, Q

Value of Q	Applicable portions of the phase diagram, $P_c = 187.506$ psia
1.0	single phase gas or vapor single phase compressed fluid at pressures above $P_c$ saturated vapor line
$0.0 < Q < 1.0$	two phase liquid-vapor region
0.0	saturated liquid line compressed liquid (fluid) states at pressures below $P_c$ liquid-solid boundary line
$-1.0 < Q < 0.0$	two phase liquid-solid region
-1.0	solid - compressed solid boundary
$Q < -1.0$	compressed solid states

### 3. OVERVIEW OF THE PROGRAMS

The decks available and described in this report are listed in table 2.

Table 2. List of Available Program Decks

Input	Output	p-hydrogen	e-hydrogen
P-T	enthalpy	PTENTH	ETENTH
	entropy	TPENTR	ETENTR
	density	PTDENS	ETDENS
	$C_p$	PTCP	ETCP
	$C_v$	entry PTCV	entry ETCV
	gamma	entry PTGAMM	entry ETGAMM
	sound velocity	PTSOUN	ETSOUN
	viscosity	PTVISC	ETVISC
	thermal conductivity	PTCOND	ETCOND
	heat transfer parameter	PTLFAC	ETLFAC
P-H	temperature, and Q	PHTEMP	EHTEMP
	entropy	PHENTR	EHENTR
	density	PHDENS	EHDENS
	$C_p$	PHCP	EHCP
	$C_v$	entry PHCV	entry EHCV
	gamma	entry PHGAMM	entry EHGAMM
	sound velocity	PHSOUN	EHSOUN
	viscosity	PHVISC	EHVISC
	thermal conductivity	PHCOND	EHCOND
	heat transfer parameter	PHLFAC	EHLFAC
<u>Saturation Routines</u>			
$P_{vap}$	$T_{vap}, H_{gas}, H_{liquid}$	PSATH	EPSATH
$T_{vap}$	$P_{vap}, H_{gas}, H_{liquid}$	TSATH	ETSATH

Including the small saturation routines there are 36 decks (the output options  $C_p$ ,  $C_v$ , and the ratio  $C_p/C_v$  are combined into one deck). Each deck exists in a CDC and an IBM version. Program listings are given in Appendix B.



### 3.1 Method Used

The conceptual idea of the computer programs follows from the use of a T-S or Mollier diagram. Using such a chart to obtain property data one visually or graphically interpolates between constant property lines. The computer programs imitate this procedure on the computer. However, in contrast to the visual procedure where any combination of existing variables can be used as entries to the chart, the computer programs are restricted to two entry possibilities, namely pressure-temperature and pressure-enthalpy.

Each property forms a surface with the two entry variables. A pre-determined number of points on this surface are calculated and form the array of data. The surface is divided into regions, the boundaries of which depend upon the relative linearity of the particular property surface. The P, T, or H spacings vary from region to region to compensate for the non-linearity of the property surface. In general, spacings will be small where the property is varying quite rapidly and they will be large where the property is varying more slowly. Each program consists of an array of data and an interpolation package. The interpolation package finds the four points which bracket the entry values and then performs a two dimensional linear interpolation to obtain the value of the property to be returned.

The arrays of data are necessarily limited. When coupled with linear interpolation, errors in the values returned are possible. We have, therefore, determined the error envelope for each program and these are displayed as departure graphs.

### 3.2 Peculiarities of the P-T Programs

One prominent feature shown in the appropriate phase diagram, figure 3, is the vapor pressure curve. In all of the P-T programs this line is mathematically thin, that is, the property value returned corresponds to either the liquid or the vapor side. In following an isobar, an isotherm, or any other path that crosses the vapor pressure curve, one will encounter sizeable changes in the different variables. In addition, for many variables these large changes also exist for conditions near or just above the critical point. Re-stating the peculiarity a different way: it is impossible to pick a P-T input which will place the coordinates inside a two phase region. Since it is often necessary to obtain property values for conditions of saturation, saturated liquid, saturated vapor, or both, we have provided a way of obtaining these values. The saturation routines listed in table 2 are designed to fill this need. They are described in Section 3.4.

### 3.3 Peculiarities of the P-H Programs

In contrast to the P-T programs it is quite possible to choose input values of P and H which place a point in question into a two phase region. From figure 4 it is seen that the boundaries of the programs are set specifically to omit returns from the liquid-solid (slush) two phase region. Returns from the liquid-vapor two phase region are, however, possible.

Three distinct possibilities or problems connected with these returns are discussed in some detail below.

The Phase Designator, Q, from PHTEMP - One problem often encountered is that we need to know where we are on the phase diagram. To solve this problem the program PHTEMP (EHTEMP) is structured slightly different than all of the other programs. The other P-H programs carry the two entry variables P and H in the call list. PHTEMP carries an additional variable, Q, in its call list. A call to PHTEMP (P, H, Q) and a check of the Q that is returned against table 1 will locate the point on the phase diagram. For example, if  $0 < Q < 1$ , then the P-H input is in the liquid-vapor coexistence region. For this region Q corresponds to the conventional quality and is defined as the percent (by mass) of the vapor phase present, or

$$Q = (H - H_{\text{liquid}}) / (H_{\text{gas}} - H_{\text{liquid}})$$

where  $H_{\text{liquid}}$  and  $H_{\text{gas}}$  are the enthalpy values at the respective phase boundary appropriate to the entry pressure (see also fig. 4). As noted before, values of Q for other parts of the phase diagram are given in table 1.

Returns from the Liquid-Vapor Two Phase Region - Assume that the input values of P and H place the point in question into the liquid-vapor two phase region. For this region the entry enthalpy H is used in all PH (EH) programs to find the phase designator or quality as defined above, and the phase designator or quality is then used to define the return, RE. For temperature, density, and entropy, these returns have the conventional meaning which is given in table 3. Other variables, that is k,  $\eta$ ,  $\omega$ ,  $C_v$ , and L, are not defined for this region in the sense of thermodynamics. However, the engineer often uses these properties in this region, and then defines them according to the specific application. Therefore, the returns given are artificial involving Q and property values corresponding to the saturated liquid and saturated vapor as defined in table 3.  $C_p$  and  $\gamma$  are infinite in this two phase region; thus the largest value available to the machine is returned. The returns are summarized in table 3.

Property Values on the Saturation Boundaries - Property values of saturation are required in many applications. From the preceding discussions it is clear that these values are simply a special case of returns from the liquid-vapor two phase region. A property value on a phase boundary is obtained from the appropriate PH (EH) program by using pressure and the saturation enthalpy, liquid or gas, as entries. The saturation enthalpies can be obtained from the two small saturation routines.

### 3.4 The Saturation Routines

For points on the saturation boundary, i.e., on the vapor pressure curve of figure 3, either P or T is sufficient to specify the conditions of the point in question (phase rule). Obviously, the pressures have to be between 1.022 and 187.506 psia and the temperatures

Table 3. Returns from the Liquid-Vapor Two Phase Region

Program		return mode	description of return
PHTEMP	EHTEMP	conventional	RE = the temperature corresponding to the input pressure (vapor pressure). Additional output: the phase designator, Q.
PHDENS	EHDENS	conventional	RE = average density of mixture $= 1.0/[Q/\rho_{\text{vapor}} + (1-Q)/\rho_{\text{liquid}}]$
PHENTR	EHENTR	conventional	RE proportional to quantities of liquid and vapor present according to the equation  $RE = Q(\pi_{\text{vapor}} - \pi_{\text{liquid}}) + \pi_{\text{liquid}}$ where $\pi$ stands for the property in question
PHCOND	EHCOND	artificial	
PHVISC	EHVISC	artificial	
PHSOUN	EHSOUN	artificial	
PHCV	EHCV	artificial	
PHLFAC	EHLFAC	artificial	
PHCP	EHCP	infinite	RE = the largest value available to the machine
PHGAMM	EHGAMM	infinite	

between 24.845 and 59.356°R. The saturation routines need to be entered with only one variable; the corresponding other variable on the vapor pressure curve is returned. In addition, the enthalpies of the saturated liquid,  $H_{\text{liquid}}$ , and the saturated vapor,  $H_{\text{gas}}$ , are returned corresponding to the two phase boundaries of figure 4. Saturation values for all other properties can then be obtained by using pressure and the appropriate saturation enthalpy as input to the desired P-H program, as shown in the example on page 16.

#### 4. PROGRAMMING INFORMATION

##### 4.1 Deck Description

All of the decks are coded as FORTRAN functions. The decks are completely self-contained, including the data arrays which are used for interpolation. Each deck may be used separately or in conjunction with others.

A prefix PT (ET) on a subprogram name means that it requires pressure-temperature as input variables while the prefix PH (EH) indicates that the input variables are pressure-enthalpy. The remainder of the deck name designates the variable returned. The names of the decks and units for input and output are given in table 4 for p-hydrogen and in table 5 for e-hydrogen. Also shown in these tables are data loading routines, storage requirements, and number of cards in each deck.

Table 4. Deck Description, p-hydrogen

Input variables and units	Deck #	Sub-program name	Output variable and unit	Extra sub-routine for data loading	Storage requirement	Number of cards in deck
pressure psia and temperature °R	1	PTENTH	enthalpy BTU/lb	CDC - 2	1717	CDC 258 IBM 256
	2	PTDENS	density lb/ft <sup>3</sup>	CDC - 3	1460	CDC 234 IBM 227
	3	PTENTR	entropy BTU/lb°R	CDC - 1	1274	CDC 208 IBM 208
	4	PTCOND	thermal conductivity BTU ft/h ft <sup>2</sup> °R	CDC - 1	1155	CDC 184 IBM 182
	5	PTVISC	viscosity lb h /ft <sup>2</sup>	CDC - 1	978	CDC 197 IBM 195
	6	PTSOUN	velocity of sound ft/s	CDC - 1	980	CDC 164 IBM 165
	7	PTCP PTCV PTGAMM	C <sub>p</sub> , BTU/lb°R C <sub>p</sub> <sup>v</sup> , BTU/lb°R γ, NONE	CDC - 4 IBM - 1	2151	CDC 292 IBM 291
	8	PTLFAC	k <sup>0.6</sup> C <sup>0.4</sup> / p <sup>0.4</sup>	CDC - 1	1157	CDC 183 IBM 180
pressure psia and enthalpy BTU/lb	9	PHTEMP	temperature °R quality see text	CDC - 1	917	CDC 160 IBM 161
	10	PHDENS	density lb/ft <sup>3</sup>	CDC - 1	1142	CDC 193 IBM 194
	11	PHENTR	entropy BTU/lb°R	CDC - 1	1130	CDC 181 IBM 180
	12	PHCOND	thermal conductivity BTU ft/h ft <sup>2</sup> °R	CDC - 1	1304	CDC 213 IBM 209
	13	PHVISC	viscosity lb h /ft <sup>2</sup>	CDC - 1	1402	CDC 266 IBM 263
	14	PHSOUN	velocity of sound, ft/s	NONE	795	CDC 145 IBM 148
	15	PHCP PHCV PHGAMM	C <sub>p</sub> , BTU/lb°R C <sub>p</sub> <sup>v</sup> , BTU/lb°R γ, NONE	CDC - 4 IBM - 1	2077	CDC 294 IBM 289
	16	PHLFAC	k <sup>0.6</sup> C <sup>0.4</sup> / p <sup>0.4</sup>	CDC - 1	1304	CDC 215 IBM 210
temperature °R	17	TSATH	vapor pressure H <sub>gas</sub> , BTU/lb H <sub>liq</sub> , BTU/lb	NONE	161	CDC 29 IBM 32
pressure psia	18	PSATH	sat. temperature H <sub>gas</sub> , BTU/lb H <sub>liq</sub> , BTU/lb	NONE	161	CDC 29 IBM 32

Table 5. Deck Description, e-hydrogen

Input variables and units	Deck #	Sub-program name	Output variable and unit	Extra sub-routine for data loading	Storage requirement	Number of cards in deck
pressure psia and temperature °R	1	ETENTH	enthalpy BTU/lb	CDC - 1	1717	CDC 279 IBM 255
	2	ETDENS	density lb/ft <sup>3</sup>	CDC - 2	1460	CDC 229 IBM 225
	3	ETENTR	entropy BTU/lb°R	CDC - 1	1274	CDC 209 IBM 206
	4	ETCOND	thermal conductivity BTU ft/h ft <sup>2</sup> °R	CDC - 1	1156	CDC 184 IBM 182
	5	ETVISC	viscosity lb h / ft <sup>2</sup>	CDC - 1	978	CDC 197 IBM 195
	6	ETSOUN	velocity of sound ft/s	CDC - 1	980	CDC 164 IBM 162
	7	ETCP ETCV ETGAMM	C <sub>p</sub> , BTU/lb°R C <sub>v</sub> , BTU/lb°R γ, NONE	CDC - 3 IBM - 1	2151	CDC 291 IBM 293
	8	ETLFAC	$k^{0.6} C_p^{0.4} / \mu^{0.4}$	CDC - 1	1157	CDC 191 IBM 180
pressure psia and enthalpy BTU/lb	9	EHTEMP	temperature °R quality see text	CDC - 1	917	CDC 161 IBM 160
	10	EHDENS	density lb/ft <sup>3</sup>	CDC - 1	1142	CDC 195 IBM 194
	11	EHENTR	entropy BTU/lb°R	CDC - 1	1130	CDC 182 IBM 180
	12	EHCOND	thermal conductivity BTU ft/h ft <sup>2</sup> °R	CDC - 1	1304	CDC 213 IBM 211
	13	EHVISC	viscosity lb h / ft <sup>2</sup>	CDC - 1	1402	CDC 267 IBM 267
	14	EHSOUN	velocity of sound, ft/s	NONE	708	CDC 141 IBM 141
	15	EHCP EHCV EHGAMM	C <sub>p</sub> , BTU/lb°R C <sub>v</sub> , BTU/lb°R γ, NONE	CDC - 2 IBM - 1	2077	CDC 289 IBM 291
	16	EHLFAC	$k^{0.6} C_p^{0.4} / \mu^{0.4}$	CDC - 1	1304	CDC 227 IBM 210
temperature °R	17	ETSATH	vapor pressure H <sub>gas</sub> , BTU/lb H <sub>liq</sub> , BTU/lb	NONE	161	CDC 30 IBM 30
pressure psia	18	EPSATH	sat. temperature H <sub>gas</sub> , BTU/lb H <sub>liq</sub> , BTU/lb	NONE	161	CDC 30 IBM 30

Since nearly every computer has available some type of FORTRAN processing language, the programs were written in FORTRAN IV. Program listings for both the CDC and the IBM versions of all decks are given in Appendix B.

#### 4.2 Calling Sequence

Since the decks are individual FORTRAN functions the calling sequences are predictably simple.

P = x, x

T = y, y

H = z, z

and then

RHO = PTDENS (P, T),

or

RHOE = EHDENS (P, H).

Provided that the values of P, T, and H are valid, that is, within the program range, the density of para hydrogen is stored into RHO or the density of equilibrium hydrogen into RHOE.

The only variation on this theme occurs for the routine PHTEMP (EHTEMP) and the saturation routines. The change occurs not in the calling sequence but rather in what information is available after the call is made. Examples are given below.

P = x, x

H = z, z

TEMP = PHTEMP(P, H, Q) or TEMP = EHTEMP(P, H, Q).

The temperature corresponding to the input pressure is found in TEMP. In addition, the phase designator Q is available through the parameter list, for example,

QUAL = Q.

Note that we did not set Q prior to the call. The saturation routines use very similar logic.

P = x, x

TVAP = PSATH(P, HG, HL) or TVAP = EPSATH(P, HG, HL)

The temperature corresponding to the input pressure (vapor pressure) is found in TVAP. In addition, the enthalpy of the saturated liquid and the enthalpy of the saturated vapor are available through the parameter list; thus

HGAS = HG, and

HLIQ = HL.

The sequence with the other saturation routine is as follows:

T = y, y

PVAP = TSATH(T, HG, HL) or PVAP = ETSATH(T, HG, HL).

Here the vapor pressure is returned in PVAP, and again the enthalpies of saturated liquid and vapor are available through the parameter list. Next, assume the call above has been made, but what really is required is the entropy of the saturated vapor. The

sequence is completed by

SGAS = PHENTR (PVAP, HG) or SGASE = EHENTR (PVAP, HG).

#### 4.3 Exceeding the Range of the Programs

It is, of course, easy to violate the range of the programs when setting the values of the input variables. The problem seems to occur frequently if unit conversions are involved. We have omitted error messages for cases of boundary violations because each installation handles printed error messages differently.

For the PT (ET) and PH (EH) programs, the out of bounds variable is automatically set to a value acceptable to the program, and computations proceed. The value returned is, of course, in error. Possible boundary violations are shown in the phase diagrams, figures 3 and 4, by dots, and the arrows indicate what conditions are actually processed. A complete description is as follows:

##### Pressure P out of bounds

If the entry pressure is less than 1 psia, the value of pressure is set to 1.

If the entry pressure is greater than 5000 psia, the returned value is extrapolated from within the defined range.

##### Temperature T out of bounds

If the entry temperature is less than the temperature appropriate to melting conditions, the temperature is set to the melting temperature at the same pressure.

If the entry temperature is greater than 6000°R, the value of temperature is set to 6000°R.

##### Enthalpy H out of bounds

If the entry enthalpy is less than the enthalpy appropriate to melting conditions, the enthalpy is set to the melting enthalpy.

If the entry enthalpy is greater than 25,000 BTU/lb, the value of the enthalpy is set to 25,000 BTU/lb.

##### Saturation routines

If either program is entered with a value outside the pressure or temperature range of the vapor pressure curve, the variable is set to the nearest end point of the curve (see figure 3).

#### 4.4 Conversion to Other Systems or Installations

The programs as listed in Appendix B were written to avoid known incompatibilities. We have tested them on a CDC 3600, a CDC 3800, and an IBM 360. Other installations have run them on an 1108 Univac. Thus, conversion requirements should be minimal. Incompatibilities that we are aware of include

DATA /...../	vs.	DATA (.....)
ABSF (.....)	vs.	ABS (.....)
EXPF (.....)	vs.	EXP (.....)

Another source of incompatibilities arises from the use of different key board symbols on certain types of card punches, i. e., ( ) + = vs. % < & ≠.

The programmer should note that the data arrays are entered via DATA statements. The upper limit on the number of such statements varies from installation to installation. The least number that we are aware of has been used. Since this means that in many cases not all of the data can be loaded with the actual program deck, we had recourse to data loading subroutines which are listed in tables 4 and 5. If a limitation is encountered, a possible solution is as follows (Goldberg, 1967):

Problem: File length not sufficient to include all DATA statements of routine PTENTH.

Solution: Two segments used, 1. BLOCK DATA, 2. Function PTENTH modified.

Details: 1. BLOCK DATA (new for PTENTH function) COMMON/BLKPTH/AA... AO, followed by the DATA statements for arrays AA through AO (total 1183 values equivalent to H array).

2. Main function PTENTH is revised to include all DATA arrays except H (1183). The H array is linked to the main function through named common: COMMON/BLKPTH/H(1183).

#### 4.5 Pitfalls, Common Errors in Applications

The earlier version of these decks has been available for nearly five years.

Several points, where users have encountered difficulties, are described below:

Storage Limitation - Each program is designed to be used independently of all others.

Specify only those decks actually required. Total storage required is specified in tables 4 and 5. Storage requirements range from 795 to 2151.

Program Range - Observe the limits of the programs 1 - 5000 psia, 24.845 - 6000°R, -130 - 25,000 BTU/lb. Valid answers will not be obtained if these bounds are violated.

Liquid-Vapor Two Phase Conditions - There is no built-in warning in any of the PH(EH) decks telling the user that he is in the liquid-vapor two phase region. This means the user should check the value of Q to confirm the conditions he is trying to process.

Liquid-Vapor Two Phase Returns - Returns from this region for the variables  $k$ ,  $\eta$ ,  $\omega$ ,  $C_p$ ,  $C_v$ ,  $\gamma$ , and  $L$ , are artificial, as defined in table 3. The programs will return numbers for these variables, but what usually is desired are not these returns but rather the property values for saturated liquid or saturated vapor.

Errors - The two categories of errors, interpolation error and estimated source data errors, are discussed in detail in Section 6. The user has to be aware of the limitations inherent in linear interpolation. The detailed graphs of maximum interpolation errors given in Appendix C should alert the user to possible problems, and serve as an aid in solving those problems.

#### 4.6 Debugging Aids

In addition to the program listings given in Appendix B, we have found that a set of selected values for the various properties is indispensable. In Appendix A we list values



obtained from the PT(ET) programs. Values for all properties for a representative set of temperatures are printed for isobars of 1, 15, 50, 150, 500, 1500, and 4500 psia. These skeleton tables are to be used to establish approximate values, to make an order of magnitude check, to check units, and to debug the running of the programs at other installations.

## 5. STRUCTURAL DETAILS OF THE PROGRAMS

As mentioned before, each program can be visualized as an array of data coupled with an interpolation scheme. Each property value entered into the data array corresponds to a particular pair of P-T or P-H. The spacing or increment for each entry variable is independent of the other and varies over the surface of the property. The total network of spacings is called the grid and a sequence of equal spacings defines a region.

### 5.1 Grid and Region Layout

The grid for each variable consists of 12 to 25 different regions. The size of each region and its relation to neighboring regions is determined by the desired interpolation error and by the relative linearity of the particular property surface. A plot of constant property lines is used as a grid in layout. An example of grid-region layout for p-hydrogen is shown in figure 5 where lines of constant  $C_p$  (in BTU/lb-°R) are plotted for entry variables P and H. Lines of constant  $C_p$  and regions G through Q are shown. Within each

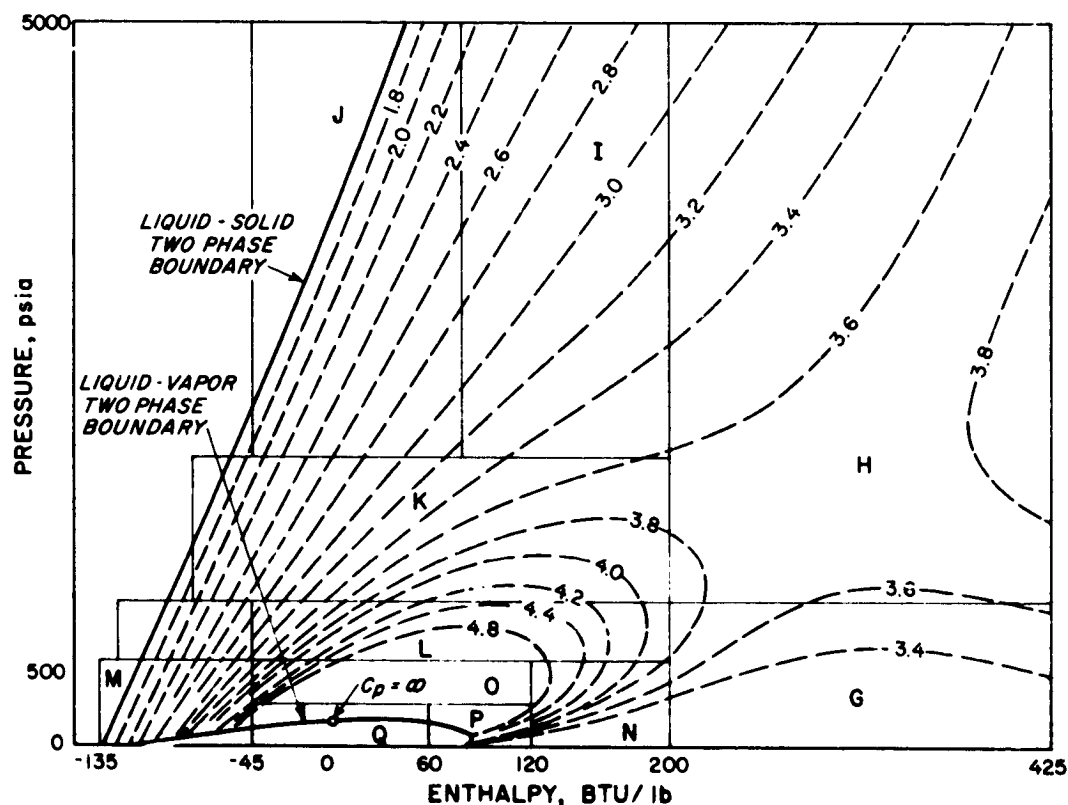


Figure 5. Region Layout for  $C_p$  with Entry Variables P-H, p-hydrogen

region increments of the entry variables, P-T or P-H, are fixed. The spacings used for the various regions were intended to yield a 1% interpolation error; however, subsequent checks show that we have not always achieved this goal. A data array developed according to this scheme will vary from variable to variable; it will minimize the number of points required to represent the surface of the variable to be interpolated.

While in general the property values entered in the data arrays are exact, there are a few cases where these entries have been adjusted to yield better results for the interpolation. One example is entries at low pressures, that is, some regions are extended to negative pressures and the entries at these negative pressures are bogus values. They do, however, insure a more precise interpolation down to the lower limit of pressure. Region B shown in the partial grid layout of figure 6 is a typical example. The lower pressure limit

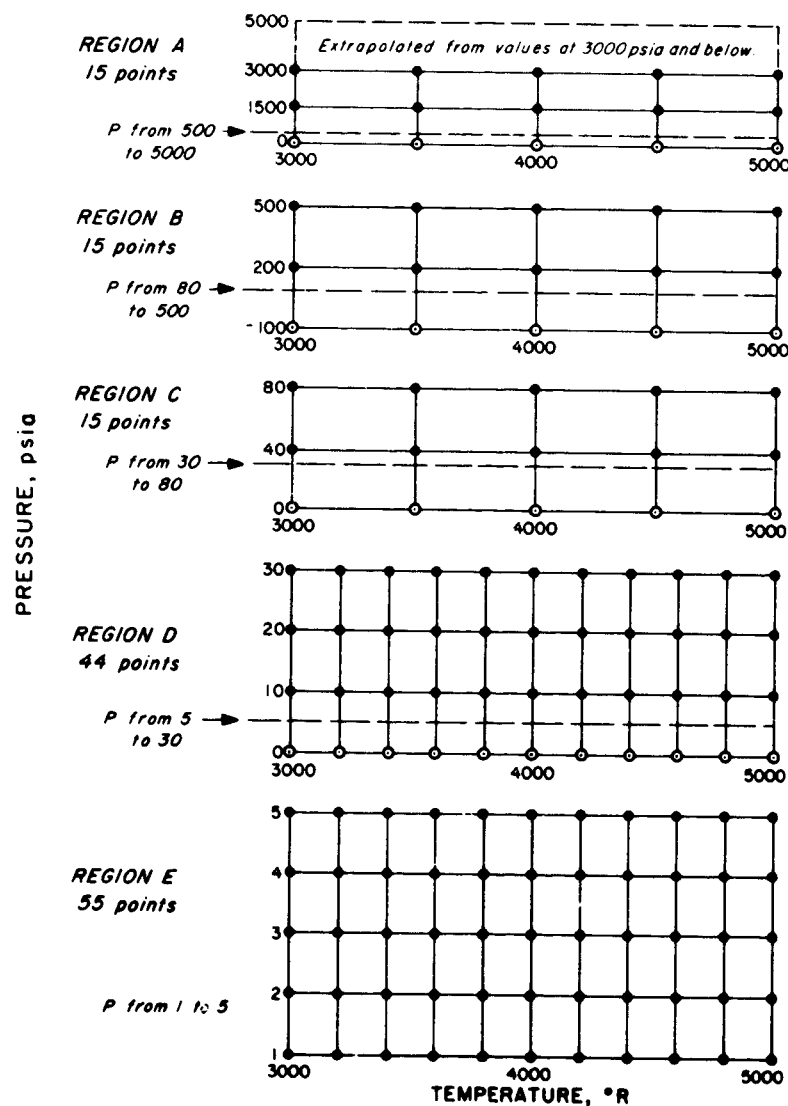


Figure 6. Partial Grid Layout for Program PTENTH

for interpolation from this region is 80 psia and entries in the data array at -100 psia are bogus values (shown as  $\odot$ ). A similar technique better described as a partial overlap of region boundaries is used in Region A, C, and D. For best accuracy values at 15 psia are interpolated from Region D, not from Regions A, B, or C. Region E is the only one illustrated in which bogus values are not used. The entire sequence illustrates how difficult it is to follow the large variation in enthalpy in the region of dissociation.

Interpolation along the two phase boundaries also involves the use of bogus points that have no counter part on the surface of the property in question. For the P-T programs, the points are across the two phase boundary while for the P-H programs they have been added inside the two phase boundaries. In either case, these bogus points are used only as interpolation aids to get from the single phase region right up to the two phase boundary.

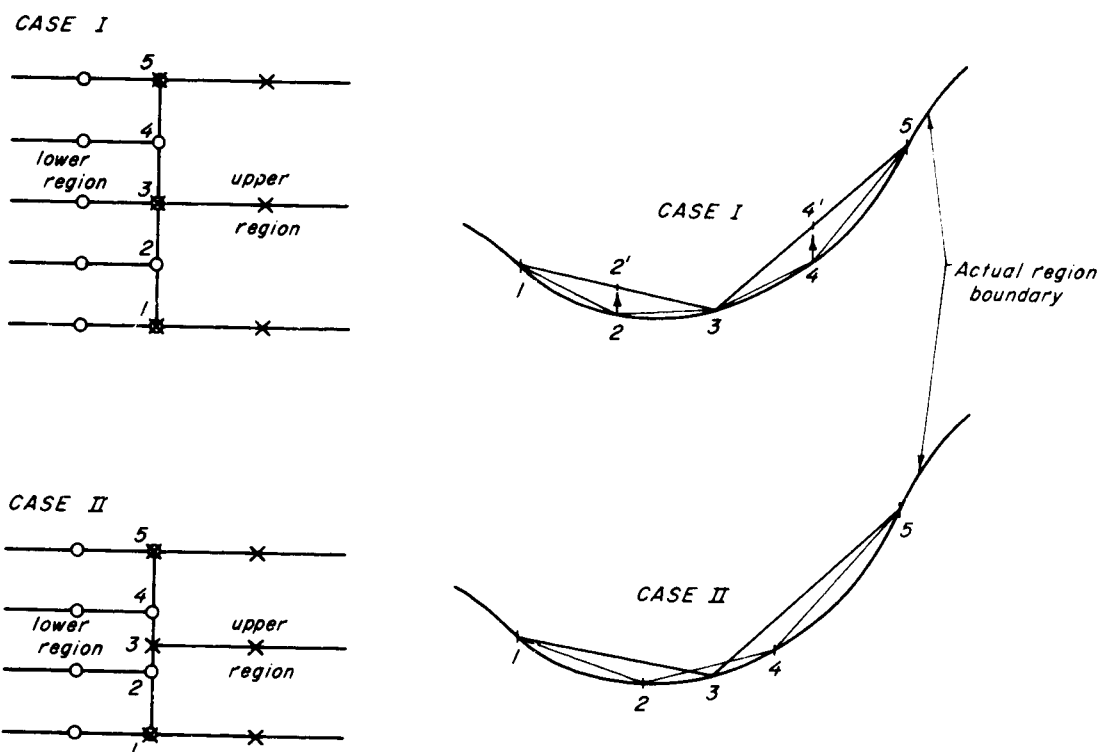
### 5.2 Speed

The programs gain their operational speed from performing two dimensional linear interpolation in a fixed array of data. Actual speed of computation depends, of course, on the particular installation. At our installation, a CDC 3800, returns run from 30,000 to 60,000 per minute. The data used for interpolation have been placed into compact DATA statements to provide rapid access. Access to any given region is just as fast as to any other region because of the way searching is arranged. The first branching divides the number of regions in half, the second in half again, and so on. Speed is reduced by about a factor of 2 if lookup of the phase boundaries is required for the point under consideration. The programs return a single answer with two variables (three for PHTEMP) going through the transfer vector.

### 5.3 Continuous Functions

In the approach taken here, continuous functions cannot be obtained because the increments of the entry variables change when crossing region boundaries. The problem is illustrated by two simple examples shown in figure 7. In case I, points 1, 2, 3, 4, and 5 lie on the boundary of the lower region, while points 1, 3, and 5 are points on the boundary of the adjacent upper region. Linear interpolation along the boundary for each region is shown by the straight lines. If points 2 and 4 are adjusted to 2' and 4', interpolation in both regions will be the same and jumps in the value of the property returned will not occur across this boundary. In case II, points 1, 2, 4, and 5 are in the lower region while 1, 3, and 5 lie in the adjacent upper region. The values of 2 and 4 cannot be adjusted to avoid a jump in the property interpolated\*. An actual example where boundaries cannot be made to match can be seen in the transition from 30 psia, Region D, to 30 psia, Region C, of figure 6.

\* We cannot adjust the value of point 3 as the interpolation error at 3 would be larger than the desired 1%.



*If the points on the boundary are common to both regions, then the boundaries can be made continuous.*

Figure 7. Matching of Values at Boundaries

#### 5.4 Modifications, Future Developments

Changes are a way of life with computer programs. Improvements will be dictated by the user — they may arise from better source data. One possible modification is described below.

**Return of Values on the Two Phase Boundary** - In many applications involving the PH (EH) programs, some of the returns are from the two phase region. In this case, the property values on the respective boundaries are required. Since the programs calculate the values at the boundaries for the regular return, a slight change in program structure will yield the desired answers. The changes are illustrated by the following example for entropy:

FUNCTION PHENTR (PRES, ENTH) change to  
 FUNCTION PHENTR (PRESS, ENTH, SGG, SLL)  
 and add at 25 + 2  
 SGG = SGAS  
 SLL = SLIQ

In other words, the new logic is similar to that used in PHTEMP(P, H, Q) and is accomplished at the expense of having two additional variables pass through the transfer vector.

**Future Possibilities** - It is interesting to speculate on improvements that might be accomplished in the future based on what we have learned about the linear interpolation scheme. An advanced scheme of interpolation would save storage, improve accuracy, and allow a large combination of variables. It would be based on the following elements:

1. The development of a single program to include
  - a) an interpolation package
  - b) a data array of fixed size, about 350 points per property.
2. The use of higher order or, perhaps spline interpolation in the interpolation package.
3. The use of the distribution in grid entries obtained during the present error analysis (see for example tables 8 and 9) to create an optimum point distribution for the new array of data.
4. A separate program which would call the generating functions (see Section 6.8) and create the array of data desired.

## 6. ESTIMATION OF ERRORS

Terms such as accuracy, precision, uncertainty, and error are used in scientific and engineering papers with many shades of meaning. To avoid ambiguity, the terms used in this report are defined as follows:

First, we define error as the quantitative difference which exists between the true value and the value which is measured, calculated, or otherwise determined.

Second, uncertainty is defined as an estimate of the error that may exist between reported and true values. Since usually we do not know the true value, the estimate is by nature a variable quantity. The estimate of error or uncertainty will vary according to the information available and the manner in which the estimate is obtained.

Statistical methods normally are used to arrive at estimates of error or uncertainties. However, statistical methods are valid only for random processes, and therefore uncertainties based on statistical methods are estimates based on the presence of random errors only. In contrast to statistics, the nature of thermophysical data is such that systematic errors usually are present, i.e., errors which are not random. Not only are systematic errors present but often they are of much greater importance than the truly random errors.

To be realistic in assigning uncertainties we have combined the estimates of both random and systematic errors, except where the uncertainties are labeled "statistical uncertainties" in which case only random errors are given. To minimize the risk of a true value being outside of the interval specified by our assigned uncertainty, the assignment of uncertainties is large enough to give a 99% chance of including the correct value, i.e., a  $3\sigma$  level. The  $\sigma$  is used here in the conventional sense of standard deviation.

Differentiation is made between uncertainties in the data of the sources chosen and interpolation error, i.e., the difference between the values returned by linear interpolation and the source chosen. Maximum interpolation errors and estimated source errors for each program are displayed graphically in Appendix C in three ranges of temperature: 25 to 180°R, 180 to 1200°R, and 1200 to 6000°R. The ranges of enthalpy for the PH and EH type

programs correspond closely to the temperature ranges just mentioned. All plots are given in percentages except for the low temperature range of enthalpy, i. e., 25 to 180°R for program PTENTH (ETENTH). The enthalpy in this range of temperature can assume both negative and positive values (see also fig. 4); therefore, the interpolation and source errors for this range only are plotted in BTU/lb. The symbol ---- in the plots signifies that the PVT surface for these temperatures is extrapolated.

Estimated source errors are discussed in some detail in Section 7. The estimated source errors are established by the authors of the source data, by comparison with experimental values, by noting the spread of values if several experimental sets exist, or by intercomparison of several methods of calculation if no experimental values are available. For the high temperature extrapolations we combine the estimates of Woolley (1972) for the ideal gas, our estimates of errors for the real gas contribution, and an arbitrary estimate for errors due to dissociation.

Interpolation errors are apt to intrude on most applications. These errors are nominally 3% except for the critical region and the region of dissociation where departures from best values become large. The critical parameters are  $P_c = 187.506$  psia,  $T_c = 59.357^\circ\text{R}$ , and  $H_c = 16.455$  BTU/lb for p-hydrogen or  $H_c = 31.225$  BTU/lb for e-hydrogen. The onset of dissociation varies from 2700°R at the lower pressures to 5400°R at the highest pressures. The interpolation errors plotted are the envelope of maximum error in interpolation at the temperature or enthalpy in question. They are established from an intercomparison of values returned by the interpolation routine and the generating functions. The comparisons are made at a large number of temperatures and a large number of pressures for each temperature, selecting the largest deviation in a given range of temperature or enthalpy for the plot. The distribution of temperatures and pressures at which the intercomparisons were made are established from the grids of the properties by collecting values at 1/2 of each normal grid increment and eliminating duplicates. As an example, each program was checked in the low temperature range at every combination of P and T given in tables 6 and 7.

Table 6. Low Temperature Error Grid, Pressures, psia

1.022	36.740	146.960	225.000	308.616	418.836	734.800	1763.520
1.500	44.088	154.308	230.000	315.964	426.184	771.540	2000.000
2.000	51.436	161.656	235.000	323.312	433.532	808.280	2500.000
3.000	58.784	169.004	240.000	330.660	440.880	845.020	2645.280
4.000	66.132	176.352	245.000	338.008	459.250	881.760	3233.120
5.000	73.480	180.026	250.000	345.356	477.620	918.500	3820.960
6.000	80.628	183.700	255.000	352.704	495.990	955.240	4408.800
7.000	88.176	187.370	260.000	360.052	514.360	991.980	5000.000
8.000	95.524	190.000	265.000	367.400	532.730	1028.720	
9.000	102.872	195.000	270.000	374.748	551.100	1065.460	
10.000	110.220	200.000	275.000	382.096	569.470	1102.200	
11.022	117.568	205.000	280.000	389.444	587.840	1138.940	
14.696	124.916	210.000	285.000	396.792	624.580	1175.680	
22.044	132.264	215.000	293.920	404.140	661.320	1322.640	
29.392	139.612	220.000	301.268	411.488	698.060	1469.600	

Table 7. Low Temperature Error Grid, Temperatures, °R

25.000	40.700	55.100	62.500	70.500	90.000
26.000	41.600	56.000	63.000	70.571	93.600
27.500	42.500	56.500	63.500	71.500	97.200
29.000	43.400	57.000	64.000	72.000	100.800
30.500	44.300	57.500	64.500	72.900	104.400
30.800	45.200	58.000	65.000	73.800	108.000
31.700	46.100	58.500	65.500	74.700	112.500
32.600	47.000	59.000	66.000	75.600	117.000
33.500	47.900	59.400	66.500	76.500	121.500
34.400	48.800	59.625	67.000	77.400	126.000
35.300	49.700	59.850	67.500	78.300	135.000
36.200	50.600	60.000	68.000	79.200	144.000
37.100	51.500	60.500	68.500	80.000	153.000
38.000	52.400	61.000	69.000	82.500	162.000
38.900	53.300	61.500	69.500	85.000	171.000
39.800	54.200	62.000	70.000	86.400	180.000

For the most part, users will be concerned only with the interpolation error because in most cases the uncertainties in the source data are negligible in comparison to the interpolation error. Interpolation errors can be established quickly by visual estimate from the appropriate plot. If the generating functions (Section 7.8) are used, only the estimated source errors need to be considered.

## 7. SOURCES OF PROPERTIES DATA

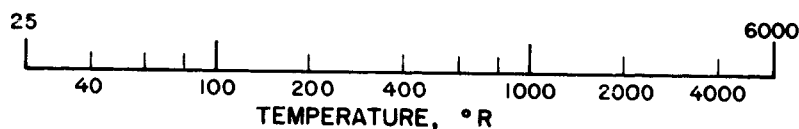
To calculate values of the various properties, we require the thermodynamic functions of the ideal gas, a description of the PVT surface, a model to calculate the effects of dissociation, and descriptions of the behavior of viscosity and thermal conductivity. The major references used are shown in figure 8 and are discussed in more detail below.

### 7.1 Ideal Gas Properties

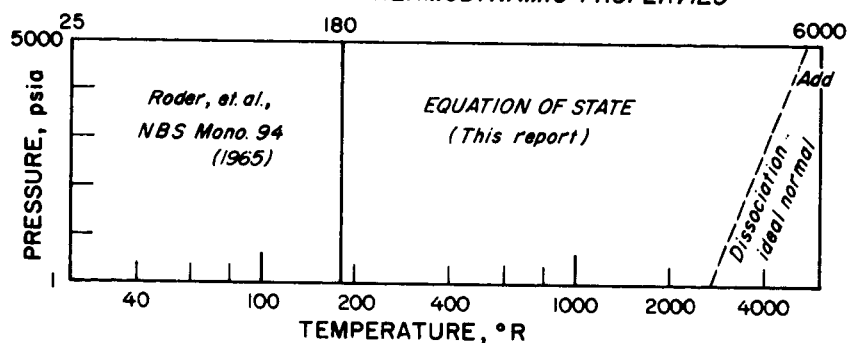
As sources for the thermodynamic properties of the ideal gas we have considered Woolley, et al. (1948), NBS Circular 564 (Hilsenrath, et al., 1955) and NBS Monograph 20 (Haar, et al., 1961). The first two sources are virtually identical; they differ only because Woolley includes the effect of nuclear spin in his tabulations for entropy (i. e.,  $2 R \ln 2$ ). Normally the nuclear spin contributions are omitted; both Circular 564 and Monograph 20 are tabulated according to this convention. Slight differences in thermal properties between Circular 564 and Monograph 20 exist. They can be detected at temperatures above 1260°R (700 K); they increase as the temperature increases. For  $C_p^0$  the difference is about 1% at 5000°R (2800 K) while for  $H^0 - E_0^0$  the difference is 44.6 BTU/lb (209 J/mol). A more recent calculation (Baehr, et al., 1966) is very close to the earlier values of Woolley, et al. (1948). We have, therefore, elected to use the properties given by Woolley for parahydrogen up to 3600°R (2000 K). At this temperature Woolley discontinues the entries for parahydrogen but continues the entries for normal hydrogen on up to 9000°R (5000 K). At 3600°R, differences between the ideal gas properties of para and normal hydrogen are

### SOURCE DATA - IDEAL GAS PROPERTIES

Woolley, et al., NBS J. Res. (1948)



### SOURCE DATA - THERMODYNAMIC PROPERTIES



### SOURCE DATA - TRANSPORT PROPERTIES

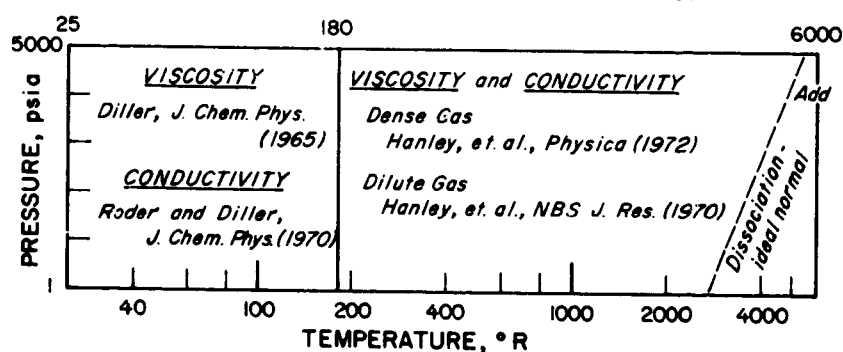


Figure 8. Primary Sources of Data

negligible except in the case of entropy where the difference is 1.367 BTU/lb-°R. The difference represents the change in order or configuration between para and normal hydrogen. Above 3600°R the next temperature entry in Woolley's tables is 5400°R (3000 K). For temperatures of 5400°R and above, the ideal gas properties of normal hydrogen were used for both para and equilibrium hydrogen since at these temperatures, equilibrium and normal hydrogen properties are identical.

While the entries for equilibrium hydrogen are perfectly proper, for parahydrogen this means that we assume complete conversion to normal hydrogen between 3600° and 5400°R. A higher order interpolation insures that the transition in entropy for the parahydrogen decks is smooth and continuous. It becomes necessary to switch to the normal mixture at some point because the dissociation calculations (Section 7.5) are based on normal hydrogen. It should be noted that the present programs are oriented toward a partic-



ular process which begins in the cryogenic range and ends at high temperatures. It would not be proper to use the parahydrogen programs on a process which begins in the cryogenic range, goes to high temperatures, and then is returned to the cryogenic range, because most likely the hydrogen would not be returned to the para form on cooling.

## 7.2 The PVT Surface at Low Temperatures

Values used in the data arrays for temperatures up to 180°R (100 K), for all properties except viscosity and thermal conductivity, were obtained from NBS Monograph 94 (Roder, et al., 1965). The uncertainties in source data were taken from this reference and are displayed as estimated source errors in Appendix C for temperatures from 25 to 180°R (-130 to 425 BTU/lb or 675 BTU/lb).

## 7.3 The PVT Surface at Intermediate Temperatures

Initially, we considered using the exponential equation of state (Woolley, et al., 1948). The difficulties with this equation are that it cannot be integrated in closed form to find the derived properties, it has a limited range, 500 to 1200°R (273 to 673 K), and the uncertainties in the derived properties cannot be calculated easily.

As an alternative we considered a modified Benedict-Webb-Rubin (1940) equation of state. The advantages of an equation of state of this type are that the functions are internally consistent and continuous. In addition, statistical uncertainties for both PVT and derived properties can be obtained from the least squares estimation of the parameters. Various modifications of this equation have been used to correlate the PVT surfaces of nitrogen (Strobridge, 1962), helium (Mann, 1962), carbon monoxide (Hust and Stewart, 1963), neon (McCarty and Stewart, 1965), argon (Gosman, et al., 1969), and oxygen (Stewart, 1966). The equation has also been used earlier on parahydrogen (Roder and Goodwin, 1961) and on an intercomparison of normal and parahydrogen (Hust and Stewart, 1965).

The PVT data used to estimate the parameters of the equation of state included the parahydrogen isotherms from 50 to 100 K (Goodwin, et al., 1963), all of the PVT sources surveyed by Woolley, et al. (1948), and the isotherms of normal hydrogen reported by Michels, et al. (1959). The equation is as follows:

$$\begin{aligned}
 P = & \rho RT + \rho^2 (N_1 T + N_2 + N_3/T + N_4/T^2 + N_5/T^4) \\
 & + \rho^3 (N_6 T^2 + N_7 T + N_8) + \rho^2 (N_9/T^2 + N_{10}/T^3 + N_{11}/T^4) e^{N_{12} \rho^2} \\
 & + N_{13} \rho^4 T + \rho^5 (N_{14}/T^2 + N_{15}/T^3 + N_{16}/T^4) e^{N_{17} \rho^2} \\
 & + N_{18} \rho^6 .
 \end{aligned}$$

The coefficients are given in table 6 for P in atm,  $\rho$  in mol/l, T in K, and R = 0.0820535 l-atm/mol-K.

Table 8. Coefficients of the Equation of State

$N_1 = 1.1389049685 \times 10^{-3}$	$N_{10} = -3.7301781349 \times 10^3$
$N_2 = 1.8072093722 \times 10^{-1}$	$N_{11} = 1.0789473341 \times 10^5$
$N_3 = -5.3097164419 \times 10^1$	$N_{12} = 8.0475741674 \times 10^{-7}$
$N_4 = 2.3690885344 \times 10^3$	$N_{13} = 1.6581404268 \times 10^{-1}$
$N_5 = -1.6306395805 \times 10^5$	$N_{14} = -1.8158230417 \times 10^1$
$N_6 = 3.2453595439 \times 10^{-8}$	$N_{15} = 4.9623738040 \times 10^2$
$N_7 = -6.3275640592 \times 10^{-7}$	$N_{16} = 5.262288563 \times 10^{-8}$
$N_8 = 2.3115255859 \times 10^{-3}$	$N_{17} = -.0018$
$N_9 = 3.4448764044 \times 10^1$	

The equation is valid over the range of the data and was used from 180 to 1200°R. Unfortunately the major sources disagree considerably at the common boundary of 180°R (see, for example, Roder, et al., 1965) and the resulting jumps in the properties are seen clearly in the plots of maximum interpolation error of Appendix C. A comparison of calculated statistical uncertainties for PVT and derived properties with the results of Roder, et al. (1965), Woolley, et al. (1948), and Michels, et al. (1959, 1963) is shown in figure 9 where the base line is the present equation of state. The comparison confirms that the values obtained for  $\sigma$  are realistic for both PVT and derived properties. For temperatures from 180 to 1200°R and enthalpies from 425 to 5000 BTU/lb the calculated uncertainties are shown as source errors in the plots of Appendix C.

#### 7.4. The PVT Extrapolation

The highest temperature for experimental PVT values is 673 K. This means the PVT surface from 1200 to 6000°R has to be extrapolated. At these temperatures the gas is nearly ideal, that is, only the lower virial coefficients contribute to the equation of state. As a first step one has to know how the virial coefficient B varies as a function of temperature, and then how much the B(T) contributes to the equation of state. The B for hydrogen attains its maximum value near 300 K. Based on what is known for helium (Keesom, 1942), the B should decrease at higher temperatures. Woolley, et al. (1948) based the temperature dependence of B on this behavior and predicted the actual temperature dependence from the Lennard-Jones (12-6) intermolecular potential function. Considering an extreme value, that is, 5000 psia (340 atm) and 5000°R (2800 K), the exponential equation of state (Woolley, et al., 1948) yields a density of 0.337 lb/ft<sup>3</sup> (60 Amagat). In the range in which this equation is valid, 360 to 1200°R (200 to 673 K), the virial B contributes less than 0.2% to the density for densities less than 60 Amagat. The contribution at higher temperatures can only be less; therefore, an extrapolation based on an equation of state which includes only the second virial coefficient is acceptable in terms of error.

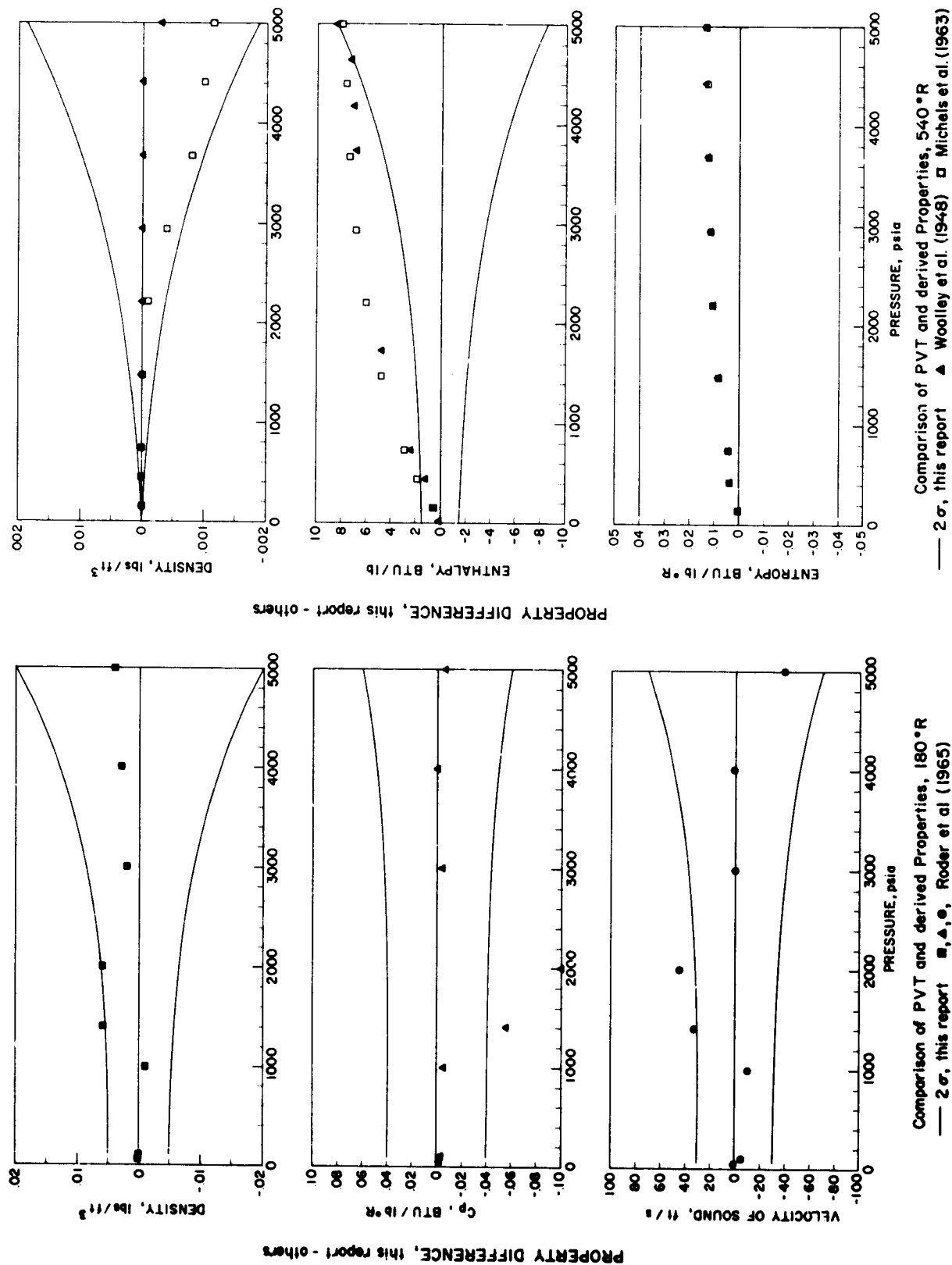


Figure 9. Comparison of PVT and Derived Properties

Next we estimate the apparent error in the extrapolation of  $B(T)$ . For  $5400^{\circ}\text{R}$  ( $3000\text{ K}$ ), extrapolation of the Woolley, et al. (1948) calculation yields  $14.55\text{ cm}^3/\text{mol}$  for  $B$  while Fisher (1965) obtained  $12.93\text{ cm}^3/\text{mol}$ . Fisher's calculation is based on a "softer" intermolecular potential function (i.e., a 9-6) and he determines the molecular parameters from the high temperature viscosity measurements of Guevara and Wageman (1965). If hydrogen at this temperature behaved as an ideal gas,  $B$  would be zero; thus a reasonable estimate for the error in  $B$  at  $5400^{\circ}\text{R}$  ( $3000\text{ K}$ ) is  $\pm 3\text{ cm}^3/\text{mol}$ .

For the data arrays we extrapolate the equation of state (Section 7.3). Since the equation was fitted over the entire range of data up to  $1200^{\circ}\text{R}$  ( $673\text{ K}$ ), only one additional constraint (Hust and McCarty, 1967) was required to yield acceptable results. The equation was constrained to yield  $14.55\text{ cm}^3/\text{mol}$  for  $B(T)$  at  $5400^{\circ}\text{R}$  ( $3000\text{ K}$ ).  $Z$  is approximately 1.04 at  $5400^{\circ}\text{R}$  and  $5000\text{ psia}$ , thus the real gas contribution is 0.04. Woolley (1972) estimates that the real gas contribution is uncertain by no more than 10%; therefore, we estimate the uncertainty in density to be 0.8% for these conditions. Uncertainties in the derived properties are estimated in a similar fashion assuming an uncertainty of no more than 10% for the real gas contribution, i.e., the contribution from non ideality. This estimate assumes virtually no error in the ideal gas thermodynamic functions and virtually no error in the dissociation calculation (Woolley, 1972).

#### 7.5 Dissociation

At the highest temperatures considered in this report, molecular hydrogen will dissociate into atoms. Dissociation is both temperature and pressure dependent. To include the effects of dissociation several assumptions are required.

1. Both ortho-para and dissociation equilibria occur instantaneously.
2. Dissociation occurs according to the equilibrium constant for normal hydrogen.
3. The property values can be obtained by adding the dissociation effects calculated for the ideal gas to the extrapolated properties of the real gas.

Fortunately, the rate of ortho-para conversion is quite high (Farkas, 1935). It is proportional to the amount of atomic hydrogen. The dissociation rates are apparently also quite high (Sutton, 1962). Assumption 1 is approximated, and thus assumption 2 is plausible. Hence, it is not necessary to consider the "hypothetical" dissociation constant for para-hydrogen (Farkas, 1935) even though the hydrogen is initially para.

The dissociation constant is calculated from the ideal gas free energies. As indicated previously, the inclusion or exclusion of nuclear spin will affect entropy as well as free energy. The tables of atomic hydrogen from NBS Circular 564 (Hilsenrath, et al., 1955) and the tables for molecular normal hydrogen from NBS Monograph 20 (Haar, et al., 1961) were used. These tables according to convention do not include the effect of nuclear spin. Equation 3.5 for free energy given by Woolley, et al., (1948) is equivalent to the table for

atomic hydrogen in Circular 564 but includes nuclear spin. The equations used to calculate dissociation effects of the ideal gas are those given by Woolley (1955).

The effects of dissociation on a variable such as enthalpy are large. They are illustrated for a limited range of temperatures and a pressure of 50 psia in figure 10 (see also figures 11 and 12). Enthalpy differences are plotted vertically and the dissociation contribution ranges from 2% to 10% of the total enthalpy. Also shown is the linear interpolation provided by program PTENTH(P, T).

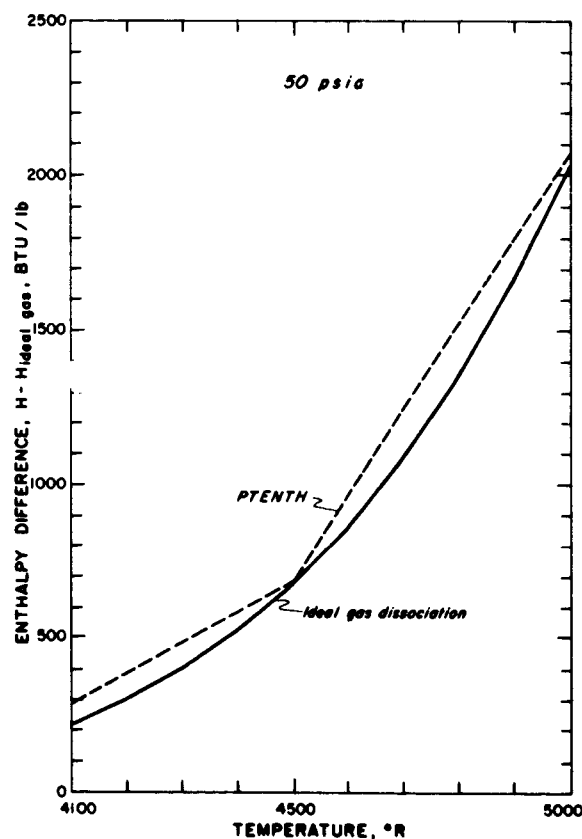


Figure 10. The Effect of Dissociation on Enthalpy

#### 7.6 Viscosity

The primary experimental sources to consider are Diller (1965) for low temperatures, and Trautz and Zink (1930) and Guevara and Wageman (1965) for high temperatures. Differences in the latter two sources have now been resolved in favor of the more recent data (Guevara, et al., 1971) allowing a critical evaluation of viscosity and thermal conductivity coefficients for the dilute gas (Hanley, et al., 1970). The coefficients are represented by standard kinetic theory expressions and are based on a model intermolecular potential function.

For temperatures up to 180 °R for both dilute and dense gas, the analytical representation of the results by Diller (1965) was chosen as source data. At intermediate and high temperatures including dissociation, the evaluation of Hanley, et al., (1970) was chosen for the dilute gas while the dense gas contributions are calculated from the theory of Enskog (Hanley, et al., 1972). The dense gas contribution vanishes at 1000 K, that is, above 1000 K the viscosity is independent of pressure or density but depends only on temperature. At yet higher temperatures with the onset of dissociation the viscosity becomes again pressure dependent as shown in figure 11 taken from Hanley, et al. (1970). We note that at the extreme temperature of 6000 °R (3333. K) the pressure dependence is still relatively small.

The uncertainty in viscosity is estimated as follows: About 2% for temperature up to 1080°R, and then gradually increasing to about 5% at 6000°R.

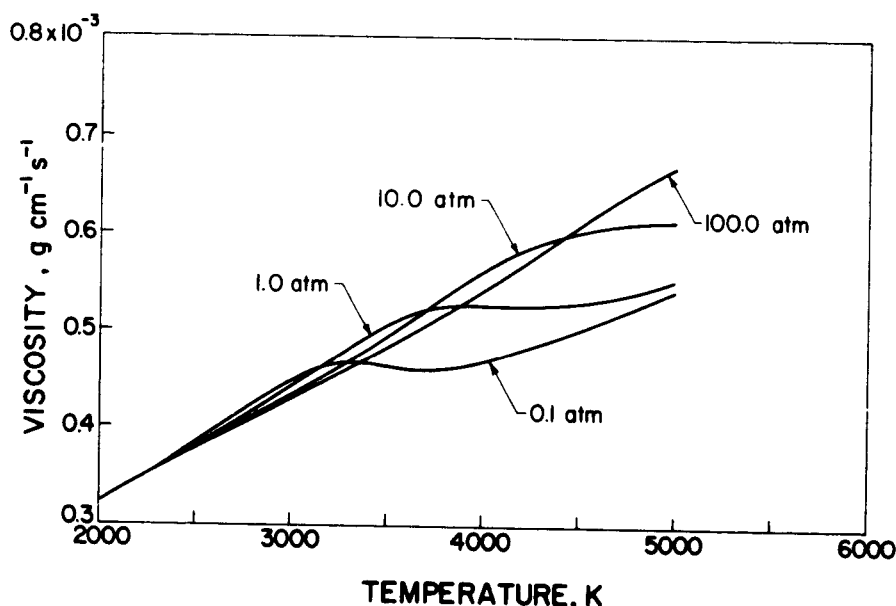


Figure 11. The Viscosity of Dissociating Hydrogen at Various Pressures

#### 7.7 Thermal Conductivity

For temperatures up to 180 °R, the analytical representation of the experimental results by Roder and Diller (1970) was chosen as source data for para hydrogen for dilute gas, dense gas, and liquid states. Dilute gas values for normal and equilibrium hydrogen differ considerably from the para values and are calculated from the change in the ideal gas heat capacity,  $C_V^0$ . The density dependence for n- and e- hydrogen is taken to be the same as para.

At higher temperatures we again select the critical evaluation by Hanley, et al., (1970) for the dilute gas and the Enskog theory calculation (Hanley, et al., 1972) for the density

(pressure) dependence. At 180 °R, taking the difference between normal and para hydrogen into account, the agreement between the experimental results by Roder and Diller (1970, para), Golubev and Kalsina (1964, normal), and the calculation by Hanley, et al. (1972) is as good as 1% for pressures up to 1500 psia and no worse than 4% at pressures of 5000 psia. Similar to viscosity, the dense gas contribution for thermal conductivity vanishes at a particular temperature (1000 K). At higher temperatures the potential function calculations agree reasonably well with the data of Blais and Mann (1960). At yet higher temperatures, the effects of dissociation on thermal conductivity become marked, see figure 12. The

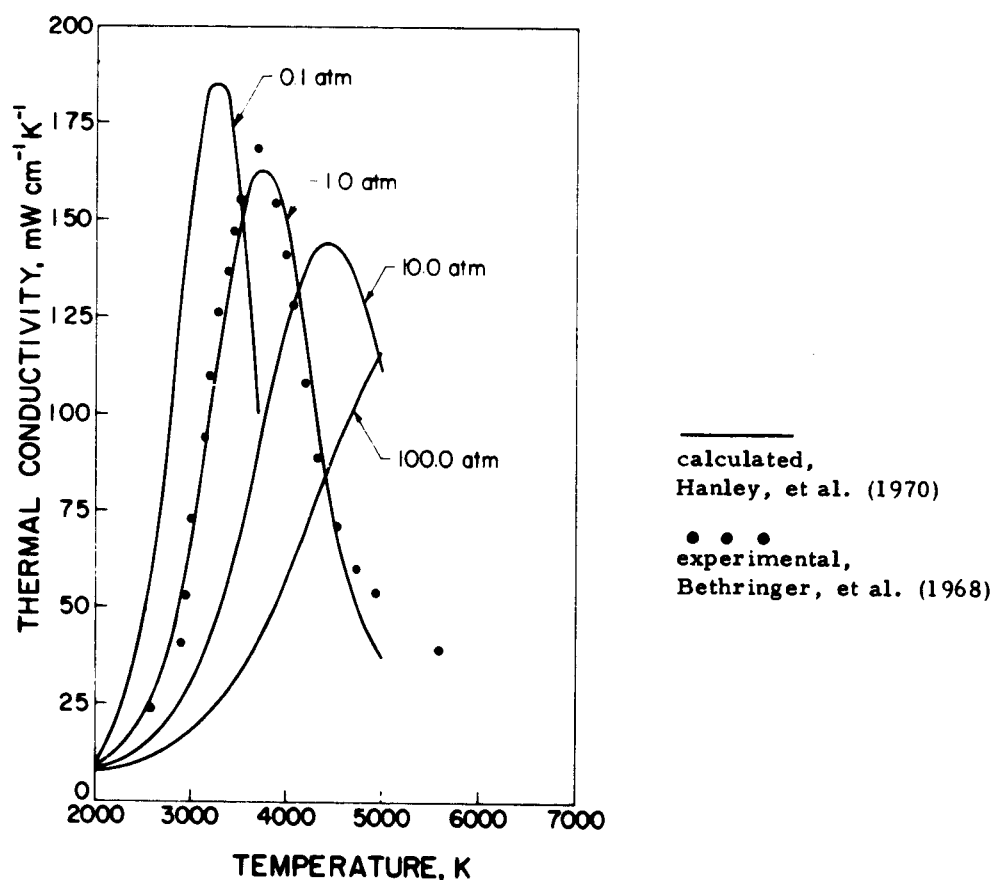


Figure 12. The Thermal Conductivity of Dissociating Hydrogen at Various Pressures

calculations become sensitive to the exact model or intermolecular potential chosen, see for example, figure 9 in the paper of Grier (1962). Two sets of data exist for the thermal conductivity in the region of dissociation. The theoretical estimates selected (Hanley, et al., 1970) are in excellent agreement with the shock wave experiment of Bethringer, et al. (1968). The data of Israel, et al., (1966) differ markedly from the former experiment and from any potential function model that could be chosen. A possible explanation is that the sintered material used in this experiment enhanced dissociation. It almost appears as if the dissociation temperatures are lowered approximately 250 K by an apparatus effect.

The uncertainty in thermal conductivity is estimated to be 3% for temperatures between 25 and 180 °R, increasing to 6% near 370 °R; about 6% for temperatures up to 3300 °R and then increasing gradually to 10% at 6000 °R. Note, however, that thermal conductivity is expected to be infinite at the critical point.

#### 7.8 Generating Functions

The programs described in the bulk of this report are designed to perform linear interpolations in arrays of data of the various properties. Each property value used in one of the arrays has to be computed in a separate operation and entered into the array. We have used several major computer programs to accomplish this task; to distinguish them from the linear interpolation programs, we call the major programs generating functions. An example of one such generating function is the program VALUES or the subroutine THERMO which was developed in the preparation of the tables presented in NBS Monograph 94 (Roder, et al., 1965). Since a number of users have requested copies of the generating functions, we list them below.

Table 9. Generating Functions \*

Temperature Range	Program Name	Input	Output
25 - 180 °R	program VALUES or subroutine THERMO	PT	$\rho, S, H, U, C_p, C_v,$ $\left(\frac{\partial P}{\partial T}\right)_\rho, \left(\frac{\partial P}{\partial \rho}\right)_T, w$
	function CONC	T, $\rho, C_p$	k
	function VISCOS	$\rho, T$	$\eta$
	program STAT	T	o - p composition and ideal gas functions, thermodynamic
180°R and up	program GO	P, T	$\rho, S, H, U, C_p, C_v,$ $\gamma, w, k, \eta$

\* A recent revision incorporates the low temperature decks except STAT, an improved equation of state for high temperatures, and a new extrapolation to 10,000 psia into a single program HYPROP, see McCarty and Weber (1972).

#### Acknowledgement

The project has been supported from its inception by the Space Nuclear Propulsion Office of NASA, later the Space Nuclear Systems Office, under NASA contracts R-45 and W13,300 as a continuation of prior support of low temperature experimental measurements on a variety of properties of hydrogen. Analysis of the transport properties at higher temperatures was supported in part by the Office of Standard Reference Data of NBS. The authors are indebted to Philip Angerhofer who prepared many of the equilibrium hydrogen routines, and Greg Hansen who prepared most of the departure graphs.



## 8. REFERENCES

- Baehr, H. D., Hartman, H., Pohl, H. C., and Schomacker, H., *Thermodynamic Functions of Ideal Gases for Temperatures up to 6000 Degrees K*, Springer Verlag Berlin Heidelberg New York, Volume 2 (1968).
- Benedict, M., Webb, G. B., and Rubin, L. C., *An Empirical Equation for Thermodynamic Properties of Light Hydrocarbons and their Mixtures I. Methane, Ethane, Propane, and n-Butane*, *J. Chem. Phys.* **8**, 334-45 (1940).
- Bethringer, K., Kollman, W., and Mentel, J., *Thermal Conductivity of Hydrogen between 2000 and 7000 K.*, *Z. Physik* **215**, 127 - 151 (1968).
- Blais, N. C., and Mann, J. B., *Thermal Conductivity of Helium and Hydrogen at High Temperatures*, *J. Chem. Phys.* **32**, 1459 - 65 (1960).
- Fisher, B. B., *Calculations of the Thermal Properties of Hydrogen*, Los Alamos Scientific Lab., N. Mex., Rept. No. LA-3364 (1965).
- Goldberg, F. N., private communication (1967).
- Golubev, I. F., and Kal'sina, M. V., *Thermoconductivity of Nitrogen and Hydrogen at Temperatures from 20 to -195 °C and Pressures from 1 to 500 Atm.* *Gaz. Prom* **9**, No. 8, 41 - 3 (1964) (SLA Transl. No. LA-TR-65-1).
- Goodwin, R. D., Diller, D. E., Roder, H. M., and Weber, L. A., *Pressure-Density-Temperature Relations of Fluid Para-Hydrogen from 15 to 100 K at Pressures to 350 Atmospheres*, *J. Res. Nat. Bur. Std. (U.S.)*, **67A** (Phys. and Chem.), No. 2, 173 - 92 (1963).
- Gosman, A. L., McCarty, R. D., and Hust, J. G., *Thermodynamic Properties of Argon from the Triple Point to 300 K at Pressures to 1000 Atmospheres*, *Nat. Stand. Ref. Data Ser., Nat. Bur. Stand. (U.S.)*, **27**, 146 pages (March 1969).
- Grier, N. T., *Calculation of Transport Properties and Heat-Transfer Parameters of Dissociating Hydrogen*, NASA (Nat. Aeron. Space Admin.) Tech. Note TN D-1406 (1962).
- Guevara, F. A., McInteer, B. B., Ottesen, B., and Hanley, H. J. M., *A Critique of the High-Temperature Viscosity Measurements of Trautz and Zink*, Los Alamos Scientific Lab., N. Mex., Rept. No. LA-4643-MS (1971).
- Guevara, F. A., and Wageman, W. E., *Measurement of Helium and Hydrogen Viscosities to 2340 K*, Los Alamos Scientific Lab., N. Mex., Rept. No. LA-3319 (1965).
- Haar, L., Friedman, A. S., and Beckett, C. W., *Ideal Gas Thermodynamic Functions and Isotope Exchange Functions for the Diatomic Hydrides, Deuterides, and Tritides*, *Nat. Bur. Std. (U.S.) Monogr.* **20** (May 1961).

- Hall, W. J., McCarty, R. D., and Roder, H. M., Computer Programs for Thermodynamic and Transport Properties of Hydrogen, Tabcode-I, unpublished (Aug. 1967).
- Hanley, H. J. M., McCarty, R. D., and Cohen, E. G. D., Analysis of the Transport Coefficients for Simple Dense Fluids: Application of the Modified Enskog Theory, *Physica* 60, 322-356 (1972).
- Hanley, H. J. M., McCarty, R. D., and Intemann, H., The Viscosity and Thermal Conductivity of Dilute Gaseous Hydrogen from 15 to 5000 K, *J. Res. Nat. Bur. Std. (U. S.)*, 74A (Phys. and Chem.), No. 3 (May-June 1970).
- Hilsenrath, J., et al., Tables of Thermal Properties of Gases Comprising Tables of Thermodynamic and Transport Properties of Air, Argon, Carbon Dioxide, Carbon Monoxide, Hydrogen, Nitrogen, Oxygen, and Steam, *Nat. Bur. Std. (U. S.)*, Circular 564 (1955).
- Hust, J. G., and McCarty, R. D., Curve-Fitting Techniques and Applications to Thermodynamics, *Cryogenics* 7, No. 4, 200 - 6 (1967).
- Hust, J. G., and Stewart, R. B., Thermodynamic Property Values for Gaseous and Liquid Carbon Monoxide from 70 to 300 K with Pressures to 300 Atmospheres, *Nat. Bur. Std. (U. S.)*, Tech. Note 202, 109 pages (Nov 1963).
- Hust, J. G., and Stewart, R. B., A Compilation of the Property Differences of Ortho and Para Hydrogen or Mixtures of Ortho and Para Hydrogen, unpublished (1965).
- Israel, S. L., Hawkins, T. D., and Hyman, S. C., Thermal Conductivity of Hydrogen from 2000 to 4700°F, United Nuclear Corp., White Plains, N. Y., Rept. No. NASA-CR-403 (1966).
- Keesom, W. H., Helium, Elsevier Pub. Co., New York (1942).
- Mann, D. B., The Thermodynamic Properties of Helium from 3 to 300 K between 0.5 and 100 Atmospheres, *Nat. Bur. Std. (U. S.)*, Tech. Note 154, 95 pages (Jan. 1962).
- McAdams, W. H., Heat Transmission, McGraw-Hill Book Co. Inc., New York, Toronto, London, 3rd Ed. (1954).
- McCarty, R. D., Computer Programs for Saturation Properties of Hydrogen, unpublished (1968).
- McCarty, R. D., and Stewart, R. B., Thermodynamic Properties of Neon from 20 to 300 K between 0.1 and 200 Atmospheres, Advances in Thermophysical Properties at Extreme Temperatures and Pressures, (Proc. 3rd Symp., Purdue Univ.) p. 84-97, ASME, New York (1965).

- McCarty, R. D., and Weber, L. A., Thermophysical Properties of Parahydrogen from the Freezing Liquid Line to 5000 R for Pressures to 10,000 psia, Nat. Bur. Std. (U. S.), Tech. Note 617, 169 pages (April 1972).
- Mechtly, E. A., The International System of Units, NASA (Natl. Aeron. Space Admin.) Spec. Publ. 7012, revised, (1969).
- Michels, A., de Graaff, W., Wassenaar, T., Levelt, J. M. H., and Louwerse, P., Compressibility Isotherms of Hydrogen and Deuterium at Temperatures between  $-175^{\circ}\text{C}$  and  $+150^{\circ}\text{C}$  (at densities up to 960 Amagat), Physica 25, 25-42 (1959).
- Michels, A., de Graaff, W., Wolkers, G. J., Thermodynamic Properties of Hydrogen and Deuterium at Temperatures between  $-175^{\circ}\text{C}$  and  $150^{\circ}\text{C}$  and at Pressures up to 2500 Atmospheres, Appl. Sci. Res. A12, 9 - 32 (1963).
- Roder, H. M., and Diller, D. E., Thermal Conductivity of Gaseous and Liquid Hydrogen, J. Chem. Phys. 52, No. 11, 5928-49 (1970).
- Roder, H. M., and Goodwin, R. D., Provisional Thermodynamic Functions for Parahydrogen, Nat. Bur. Std. (U. S.), Tech. Note 130, 139 pages (Dec 1961).
- Roder, H. M., Weber, L. A., and Goodwin, R. D., Thermodynamic and Related Properties of Parahydrogen from the Triple Point to 100 K at Pressures to 340 Atmospheres, Nat. Bur. Std. (U. S.), Monogr. 94, 112 pages (Aug 1965).
- Stewart, R. B., The Thermodynamic Properties of Oxygen, State Univ. of Iowa, Iowa City, Ph.D. Thesis (1966).
- Strobridge, T. R., The Thermodynamic Properties of Nitrogen from 64 to 300 K between 0.1 and 200 Atmospheres, Nat. Bur. Std. (U. S.), Tech. Note 129, 85 pages (Jan 1962).
- Sutton, E. A., Measurement of the Dissociation Rates of Hydrogen and Deuterium, J. Chem. Phys. 36, No. 11, 2923-31 (1962).
- Trautz, M., and Zink, R., Die Reibung, Wärmeleitung, und Diffusion in Gasmischung. XII. Gasreibung bei höheren Temperaturen, Ann. Physik 7, 427-52 (1930).
- Woolley, H. W., private communication (1972).
- Woolley, H. W., Effect of Dissociation on Thermodynamic Properties of Pure Diatomic Gases, Nat. Advisory Comm. Aeronaut. Tech. Note 3270 (1955).
- Woolley, H. W., Scott, R. B., and Brickwedde, F. G., Compilation of Thermal Properties of Hydrogen in its Various Isotopic and Ortho-para Modifications J. Res. Nat. Bur. Std. (U. S.), 41, 379-475 (1948).

## APPENDIX A

### Tables of Values for Selected Isobars

Parahydrogen (Output from PT programs) . . . . .	38
Equilibrium Hydrogen (Output from ET programs). . .	45

PARAHYDROGEN (OUTPUT FROM PT PROGRAMS)

PRESSURE	TEMPERATURE	ENTHALPY	DENSITY	ENTROPY	CONDUCTIVITY	VISCOSITY	VEL. SOUND	C-P	C-V	GR/V	L
PSIA	DEG. R	BTU/LB	LB/CU.FT	BTU/LB-R	BTU/H -FT-R	LB-IN	FT/S	BTU/LB-R	BTU/LB-R	RATIO	FACTOR
1	25	60.77	0.0075644	8.992	0.007202	0.3449	1011	2.531	1.483	1.707	2517
1	30	73.22	0.0063539	9.430	0.007996	0.3032	1104	2.436	1.431	1.686	2507
1	35	85.67	0.0054165	9.806	0.008791	0.2615	1196	2.370	1.400	1.660	2577
1	40	98.03	0.0047232	10.124	0.009972	0.2694	1282	2.356	1.440	1.660	2626
1	45	110.42	0.0041880	10.442	0.011250	0.2781	1362	2.351	1.479	1.657	2693
1	50	122.83	0.0037698	10.703	0.012487	0.2864	1436	2.351	1.479	1.658	2754
1	55	135.20	0.0034264	10.931	0.013697	0.2946	1504	2.365	1.479	1.666	2810
1	60	147.49	0.0031400	11.159	0.014875	0.3020	1570	2.369	1.479	1.670	2862
1	65	159.88	0.0028977	11.351	0.016005	0.3095	1633	2.369	1.479	1.670	2907
1	70	172.25	0.0026892	11.532	0.017134	0.3163	1695	2.369	1.479	1.668	2952
1	75	184.62	0.0025123	11.712	0.018256	0.3239	1754	2.370	1.480	1.666	2996
1	80	196.90	0.0023504	11.866	0.019341	0.3307	1812	2.373	1.482	1.666	3040
1	85	209.27	0.0022136	12.017	0.020510	0.3375	1865	2.373	1.482	1.665	3085
1	90	222.04	0.0020914	12.170	0.021623	0.3443	1918	2.373	1.482	1.664	3130
1	95	234.47	0.0019739	12.286	0.022747	0.3505	1967	2.373	1.482	1.662	3175
1	100	246.90	0.0018805	12.421	0.023882	0.3570	2016	2.373	1.482	1.656	3220
1	110	271.97	0.0017165	12.663	0.026288	0.3631	2104	2.373	1.482	1.651	3265
1	120	297.87	0.0015733	12.875	0.028695	0.3691	2193	2.373	1.482	1.646	3310
1	130	324.29	0.0014530	13.057	0.031184	0.3750	2283	2.373	1.482	1.641	3355
1	140	351.46	0.0013465	13.299	0.033672	0.3809	2373	2.373	1.482	1.636	3400
1	150	379.70	0.0012549	13.495	0.036160	0.3868	2463	2.373	1.482	1.631	3445
1	160	408.66	0.0011773	13.681	0.039780	0.3927	2553	2.373	1.482	1.626	3490
1	170	437.26	0.0011071	13.867	0.042765	0.3986	2643	2.373	1.482	1.621	3535
1	180	465.69	0.0010470	14.060	0.046150	0.4045	2733	2.373	1.482	1.616	3580
1	190	492.37	0.0009918	14.233	0.049327	0.4104	2823	2.373	1.482	1.611	3625
1	200	519.06	0.0009367	14.395	0.052504	0.4163	2913	2.373	1.482	1.606	3670
1	250	722.51	0.0007350	15.198	0.058390	0.4307	3003	2.373	1.482	1.601	3715
1	300	910.33	0.0005377	15.985	0.067954	0.4451	3093	2.373	1.482	1.596	3760
1	350	1103.65	0.0004219	16.510	0.080790	0.4595	3183	2.373	1.482	1.591	3805
1	400	1295.31	0.0003573	17.010	0.095114	0.4739	3273	2.373	1.482	1.586	3850
1	450	1479.37	0.0003069	17.450	0.101040	0.4883	3363	2.373	1.482	1.581	3895
1	500	1663.02	0.0003747	17.850	0.106702	0.4995	3453	2.373	1.482	1.576	3940
1	550	1837.42	0.0003436	18.123	0.112552	0.5107	3543	2.373	1.482	1.571	3985
1	600	2011.82	0.0003125	18.297	0.118601	0.5201	3633	2.373	1.482	1.566	4030
1	700	2360.62	0.0002679	19.443	0.130501	0.5495	3723	2.373	1.482	1.561	4075
1	800	2739.42	0.0002365	19.490	0.142401	0.5694	3813	2.373	1.482	1.556	4120
1	900	3058.22	0.0002085	19.860	0.154300	0.5893	3903	2.373	1.482	1.551	4165
1	1000	3437.02	0.0001877	20.230	0.166200	0.6092	3993	2.373	1.482	1.546	4210
1	1250	4279.02	0.0001505	21.023	0.194000	0.6591	4083	2.373	1.482	1.541	4255
1	1500	5151.02	0.0001252	21.667	0.221900	0.7090	4173	2.373	1.482	1.536	4300
1	1750	6043.02	0.0001076	22.218	0.249750	0.7589	4263	2.373	1.482	1.531	4345
1	2000	6935.02	0.0000942	22.710	0.277700	0.8088	4353	2.373	1.482	1.526	4390
1	2250	7827.02	0.0000837	23.120	0.306950	0.8587	4443	2.373	1.482	1.521	4435
1	2500	8719.02	0.0000752	23.530	0.336200	0.9086	4533	2.373	1.482	1.516	4480
1	2750	9611.02	0.0000689	23.885	0.365450	0.9585	4623	2.373	1.482	1.511	4525
1	3000	10503.02	0.0000627	24.240	0.394700	1.0084	4713	2.373	1.482	1.506	4570
1	3250	11395.02	0.0000582	24.575	0.423950	1.0583	4803	2.373	1.482	1.501	4615
1	3500	12287.02	0.0000536	24.910	0.453200	1.1082	4893	2.373	1.482	1.496	4660
1	3750	13179.02	0.0000501	25.310	0.482450	1.1581	4983	2.373	1.482	1.491	4705
1	4000	14071.02	0.0000465	25.710	0.511700	1.2080	5073	2.373	1.482	1.486	4750
1	4250	14963.02	0.0000432	26.365	0.540950	1.2579	5163	2.373	1.482	1.481	4795
1	4500	15855.02	0.0000400	27.020	0.570200	1.3078	5253	2.373	1.482	1.476	4840
1	4750	16747.02	0.0000364	28.220	0.599450	1.3577	5343	2.373	1.482	1.471	4885
1	5000	17639.02	0.0000329	29.420	0.628700	1.4076	5433	2.373	1.482	1.466	4930
1	5250	18531.02	0.0000293	31.140	0.657950	1.4575	5523	2.373	1.482	1.461	4975
1	5500	19423.02	0.0000258	33.460	0.687200	1.5074	5613	2.373	1.482	1.456	5020
1	5750	20315.02	0.0000226	35.965	0.716450	1.5573	5703	2.373	1.482	1.451	5065
1	6000	21207.02	0.0000195	38.470	0.745700	1.6072	5793	2.373	1.482	1.446	5110

PARAHYDROGEN (OUTPUT FROM PT PROGRAMS)

PSIA	TEMPERATURE DEG. R	ENTHALPY BTU/LB	DENSITY LB/CU.FT	ENTROPY BTU/LB-R	CONDUCTIVITY BTU/H-FT-R	VISCOSITY LB-FT/SQ.FT *10**10	VEL.SOUND FT/S	C-P BTU/LB-R	C-V BTU/LB-R	CP/CV RATIO	I FACTOR
15	25	-132.60	4.8165105	1.192	0.043212	1.4436	4174	1.563	1.129	1.384	1537
15	30	-123.37	4.6443963	1.503	0.053047	1.0838	3998	1.845	1.242	1.485	1523
15	35	-113.19	4.4722821	1.813	0.063319	0.8333	3657	2.206	1.344	1.641	2625
15	40	-98.27	4.0768321	7.375	0.010575	0.0719	1233	2.798	1.532	1.826	2813
15	45	183.72	8.0667821	7.765	0.011732	0.0800	1322	2.790	1.831	1.831	2835
15	50	117.39	0.0590916	7.979	0.012893	0.0880	1404	2.643	1.501	1.764	2864
15	55	130.63	0.0538733	8.221	0.014053	0.0960	1481	2.509	1.495	1.745	2896
15	60	143.56	0.0482165	8.463	0.015188	0.1033	1553	2.528	1.491	1.729	2930
15	65	156.42	0.0434442	8.663	0.016296	0.1106	1620	2.552	1.488	1.715	2966
15	70	169.12	0.0404964	8.849	0.017404	0.1179	1685	2.578	1.488	1.706	3002
15	75	181.80	0.0383351	9.035	0.018513	0.1249	1746	2.598	1.488	1.699	3040
15	80	194.36	0.0357877	9.191	0.019672	0.1316	1806	2.524	1.490	1.694	3087
15	85	206.98	0.0337205	9.343	0.020751	0.1383	1860	2.523	1.494	1.688	3125
15	90	219.78	0.0316321	9.486	0.021767	0.1450	1914	2.522	1.499	1.682	3165
15	95	232.48	0.0298067	9.624	0.022987	0.1512	1964	2.537	1.501	1.674	3206
15	100	245.01	0.0283662	9.752	0.024183	0.1577	2014	2.570	1.562	1.645	3246
15	110	270.43	0.0257886	10.000	0.026546	0.1698	2103	2.622	1.617	1.621	3270
15	120	296.55	0.0236160	10.214	0.028908	0.1815	2185	2.695	1.695	1.590	3598
15	130	323.15	0.0218001	10.427	0.031373	0.1927	2249	2.784	1.706	1.559	3726
15	140	350.47	0.0202015	10.640	0.033839	0.2037	2314	2.874	1.877	1.531	3849
15	150	378.83	0.0188253	10.847	0.036832	0.2143	2378	2.984	1.990	1.501	4171
15	160	407.88	0.0176616	11.050	0.039926	0.2241	2430	3.096	2.102	1.473	4250
15	170	436.66	0.0166080	11.252	0.043103	0.2341	2483	3.206	2.215	1.448	4427
15	180	465.28	0.0157050	11.445	0.046287	0.2441	2535	3.313	2.321	1.427	4584
15	190	502.00	0.0148775	11.608	0.049461	0.2547	2585	3.419	2.427	1.409	4741
15	200	538.72	0.0140500	11.771	0.052634	0.2654	2635	3.524	2.539	1.386	4898
15	250	722.33	0.0110250	12.587	0.068501	0.3012	2889	3.793	2.804	1.353	5524
15	300	909.98	0.0091163	13.273	0.079636	0.3431	3147	3.929	2.941	1.316	5796
15	350	1103.69	0.0078281	13.896	0.088854	0.3832	3404	3.940	2.853	1.346	5902
15	400	1295.43	0.0068594	14.399	0.095166	0.4204	3660	3.751	2.768	1.356	5815
15	450	1479.25	0.0061031	14.838	0.101079	0.4561	3895	3.570	2.684	1.367	5817
15	500	1663.25	0.0056205	15.235	0.106726	0.4907	4122	3.588	2.602	1.379	5785
15	550	1837.66	0.0051540	15.509	0.112673	0.5201	4336	3.548	2.562	1.385	5823
15	600	2012.07	0.0046875	15.783	0.118621	0.5496	4535	3.557	2.522	1.391	5812
15	700	2360.89	0.0040185	16.332	0.130516	0.6084	4907	3.473	2.493	1.395	5939
15	800	2709.71	0.0035175	16.880	0.142410	0.6673	5251	3.469	2.485	1.396	6116
15	900	3058.93	0.0031275	17.250	0.154305	0.7261	5531	3.475	2.490	1.395	6303
15	1000	3407.35	0.0028155	17.620	0.166200	0.7850	5811	3.481	2.496	1.395	6471
15	1250	4279.36	0.0022575	18.410	0.194003	0.9087	6511	3.495	2.510	1.392	6398
15	1500	5151.36	0.0018780	19.058	0.221803	1.0325	7147	3.524	2.539	1.388	6544
15	1750	6033.16	0.0016141	19.612	0.249750	1.1439	7686	3.574	2.599	1.390	6774
15	2000	6935.36	0.0014132	20.095	0.277700	1.2554	8229	3.624	2.679	1.373	7312
15	2250	7859.36	0.0012552	20.476	0.306948	1.3584	8678	3.694	2.709	1.364	7814
15	2500	8793.35	0.0011256	20.857	0.336196	1.4622	9126	3.764	2.779	1.354	7995
15	2750	9751.83	0.0010320	21.239	0.373057	1.5591	9534	3.845	2.860	1.345	7966
15	3000	10720.00	0.0009384	21.620	0.397600	1.6565	9916	3.931	2.944	1.335	8122
15	3250	11703.75	0.0008714	21.931	0.437113	1.7490	10283	4.064	3.076	1.323	8514
15	3500	12740.00	0.0008044	22.243	0.491850	1.8415	10589	4.273	3.267	1.307	9103
15	3750	13840.00	0.0007534	22.554	0.575012	1.9309	10895	4.572	3.548	1.289	10343
15	4000	15035.00	0.0007024	22.865	0.705750	2.1038	11366	5.163	4.093	1.263	11550
15	4250	16436.25	0.0006611	23.290	0.927138	2.1933	11857	5.972	4.819	1.239	14392
15	4500	18102.50	0.0006197	23.715	1.263750	2.2945	12451	7.302	6.006	1.216	18482
15	4750	20158.75	0.0005831	24.140	1.751375	2.4945	12857	9.228	7.690	1.200	24267
15	5000	22755.00	0.0005465	24.565	2.424000	2.8948	13565	11.550	9.705	1.190	32151
15	5250	26206.25	0.0005114	25.483	3.342250	2.4969	12451	15.169	12.704	1.194	42746
15	5500	30622.50	0.0004762	26.400	4.688500	2.6003	12792	19.333	15.370	1.202	54455
15	5750	36190.00	0.0004416	27.317	5.753000	2.7071	13167	24.334	19.970	1.218	68912
15	6000	43075.00	0.0004070	28.235	7.098499	2.8142	13565	28.980	24.150	1.238	89610

PAPAYERGEN (OUTPUT FROM PT PROGRAMS)

PSIA	TEMPERATURE DEG. F	ENTHALPY BTU/LB	DENSITY LB/CU.FT	ENTROPY BTU/LB-°F	CONDUCTIVITY BTU/IN-°F	VISCOSITY LB/IN-SEC	VELOCITY FT/SEC	C-P BTU/LB-°F	C-V BTU/LB-°F	CF/CM RATIO	L FACTOR
50	25	-156.01	4.8285905	1.185	0.043421	1.4669	4196	1.560	1.130	1.340	1.27
50	30	-122.27	4.6593210	1.493	0.053271	1.1025	3335	1.813	1.243	1.424	1.10
50	35	-112.17	4.4900515	1.801	0.066689	0.9478	3698	2.148	1.343	1.599	2.08
50	40	-100.21	4.2833894	2.127	0.085653	0.7676	3442	2.550	1.416	1.831	3.10
50	45	-85.58	4.0573792	2.456	0.057643	0.5478	3101	3.297	1.467	2.248	3.64
50	50	-72.83	3.8243215	6.574	0.014263	0.3920	1324	3.254	1.570	2.673	3.24
50	55	-61.63	3.5944614	6.875	0.015167	0.0994	1424	3.005	1.542	1.949	3.19
50	60	-51.43	3.3728893	7.122	0.016117	0.1064	1510	2.863	1.523	1.843	3.16
50	65	-42.57	3.1567762	7.330	0.017135	0.1135	1588	2.741	1.511	1.842	3.14
50	70	-34.19	2.9437162	7.528	0.018161	0.1205	1660	2.721	1.506	1.807	3.10
50	75	-26.75	2.7326472	7.733	0.019218	0.1272	1726	2.680	1.503	1.743	3.10
50	80	-19.03	2.5230287	7.895	0.020420	0.1333	1791	2.650	1.503	1.764	3.10
50	85	-11.24	2.3130166	8.051	0.021833	0.1404	1844	2.633	1.506	1.749	3.10
50	90	-3.42	2.1027792	8.275	0.023533	0.1470	1906	2.615	1.509	1.733	3.10
50	95	227.21	0.1014794	8.407	0.023567	0.1531	1958	2.611	1.519	1.719	3.10
50	100	240.30	0.0959951	8.539	0.024935	0.1595	2010	2.600	1.522	1.705	3.10
50	110	266.54	0.0872226	8.794	0.027188	0.1714	2102	2.624	1.568	1.675	3.10
50	120	293.24	0.0795757	9.009	0.029442	0.1830	2190	2.644	1.622	1.645	3.10
50	130	320.36	0.0732407	9.225	0.031847	0.1942	2255	2.735	1.598	1.611	3.10
50	140	347.98	0.0677055	9.441	0.034252	0.2050	2319	2.819	1.788	1.575	3.10
50	150	376.64	0.0629936	9.650	0.037271	0.2156	2384	2.920	1.879	1.543	3.10
50	160	405.95	0.0590316	9.854	0.040290	0.2253	2430	3.034	1.991	1.511	4.09
50	170	435.16	0.0554533	10.058	0.043449	0.2353	2470	3.116	2.103	1.472	4.22
50	180	464.27	0.0523500	10.264	0.046631	0.2476	2513	3.254	2.215	1.455	4.45
50	190	501.07	0.0495917	10.428	0.049755	0.2603	2562	3.339	2.322	1.434	4.20
50	200	537.47	0.0468333	10.592	0.052959	0.2662	2647	3.434	2.428	1.414	4.75
50	250	721.97	0.0367500	11.411	0.068773	0.3422	2897	3.815	2.946	1.337	5.93
50	300	909.95	0.0303875	12.098	0.079863	0.3442	3155	3.915	2.946	1.337	5.93
50	350	1103.80	0.0250934	12.721	0.089330	0.3440	3411	3.465	2.855	1.367	5.97
50	400	1295.75	0.0228646	13.224	0.095295	0.4210	3667	3.755	2.767	1.357	5.99
50	450	1479.71	0.0203434	13.663	0.101175	0.4565	3902	3.672	2.685	1.368	5.90
50	500	1663.45	0.0187350	14.060	0.106787	0.4910	4128	3.590	2.603	1.370	5.76
50	550	1838.20	0.0171800	14.335	0.112724	0.5203	4362	3.524	2.563	1.385	5.94
50	600	2012.71	0.0156250	14.610	0.118669	0.5437	4561	3.504	2.523	1.391	5.96
50	650	2181.58	0.01433950	14.860	0.125052	0.6044	4813	3.473	2.494	1.395	5.93
50	700	2361.44	0.0131720	15.100	0.130552	0.6673	5055	3.473	2.485	1.396	6.01
50	750	2549.31	0.01204250	15.310	0.134235	0.7257	5255	3.473	2.490	1.395	6.10
50	800	2710.44	0.01093850	15.498	0.136417	0.7844	5416	3.441	2.496	1.395	6.17
50	850	2859.17	0.00993850	15.647	0.136417	0.8444	5516	3.441	2.496	1.395	6.17
50	900	3008.17	0.00903850	15.775	0.136417	0.9044	5516	3.441	2.496	1.395	6.17
50	950	3157.17	0.00813850	15.883	0.136417	0.9644	5516	3.441	2.496	1.395	6.17
50	1000	3306.17	0.00723850	15.920	0.136417	1.0244	5516	3.441	2.496	1.395	6.17
50	1050	3455.17	0.00633850	15.920	0.136417	1.0844	5516	3.441	2.496	1.395	6.17
50	1100	3604.17	0.00543850	15.920	0.136417	1.1444	5516	3.441	2.496	1.395	6.17
50	1150	3753.17	0.00453850	15.920	0.136417	1.2044	5516	3.441	2.496	1.395	6.17
50	1200	3902.17	0.00363850	15.920	0.136417	1.2644	5516	3.441	2.496	1.395	6.17
50	1250	4051.17	0.00273850	15.920	0.136417	1.3244	5516	3.441	2.496	1.395	6.17
50	1300	4200.17	0.00183850	15.920	0.136417	1.3844	5516	3.441	2.496	1.395	6.17
50	1350	4349.17	0.00093850	15.920	0.136417	1.4444	5516	3.441	2.496	1.395	6.17
50	1400	4498.17	0.00003850	15.920	0.136417	1.5044	5516	3.441	2.496	1.395	6.17
50	1450	4647.17	0.00003850	15.920	0.136417	1.5644	5516	3.441	2.496	1.395	6.17
50	1500	4796.17	0.00003850	15.920	0.136417	1.6244	5516	3.441	2.496	1.395	6.17
50	1550	4945.17	0.00003850	15.920	0.136417	1.6844	5516	3.441	2.496	1.395	6.17
50	1600	5094.17	0.00003850	15.920	0.136417	1.7444	5516	3.441	2.496	1.395	6.17
50	1650	5243.17	0.00003850	15.920	0.136417	1.8044	5516	3.441	2.496	1.395	6.17
50	1700	5392.17	0.00003850	15.920	0.136417	1.8644	5516	3.441	2.496	1.395	6.17
50	1750	5541.17	0.00003850	15.920	0.136417	1.9244	5516	3.441	2.496	1.395	6.17
50	1800	5690.17	0.00003850	15.920	0.136417	1.9844	5516	3.441	2.496	1.395	6.17
50	1850	5839.17	0.00003850	15.920	0.136417	2.0444	5516	3.441	2.496	1.395	6.17
50	1900	5988.17	0.00003850	15.920	0.136417	2.1044	5516	3.441	2.496	1.395	6.17
50	1950	6137.17	0.00003850	15.920	0.136417	2.1644	5516	3.441	2.496	1.395	6.17
50	2000	6286.17	0.00003850	15.920	0.136417	2.2244	5516	3.441	2.496	1.395	6.17
50	2050	6435.17	0.00003850	15.920	0.136417	2.2844	5516	3.441	2.496	1.395	6.17
50	2100	6584.17	0.00003850	15.920	0.136417	2.3444	5516	3.441	2.496	1.395	6.17
50	2150	6733.17	0.00003850	15.920	0.136417	2.4044	5516	3.441	2.496	1.395	6.17
50	2200	6882.17	0.00003850	15.920	0.136417	2.4644	5516	3.441	2.496	1.395	6.17
50	2250	7031.17	0.00003850	15.920	0.136417	2.5244	5516	3.441	2.496	1.395	6.17
50	2300	7180.17	0.00003850	15.920	0.136417	2.5844	5516	3.441	2.496	1.395	6.17
50	2350	7329.17	0.00003850	15.920	0.136417	2.6444	5516	3.441	2.496	1.395	6.17
50	2400	7478.17	0.00003850	15.920	0.136417	2.7044	5516	3.441	2.496	1.395	6.17
50	2450	7627.17	0.00003850	15.920	0.136417	2.7644	5516	3.441	2.496	1.395	6.17
50	2500	7776.17	0.00003850	15.920	0.136417	2.8244	5516	3.441	2.496	1.395	6.17
50	2550	7925.17	0.00003850	15.920	0.136417	2.8844	5516	3.441	2.496	1.395	6.17
50	2600	8074.17	0.00003850	15.920	0.136417	2.9444	5516	3.441	2.496	1.395	6.17
50	2650	8223.17	0.00003850	15.920	0.136417	3.0044	5516	3.441	2.496	1.395	6.17
50	2700	8372.17	0.00003850	15.920	0.136417	3.0644	5516	3.441	2.496	1.395	6.17
50	2750	8521.17	0.00003850	15.920	0.136417	3.1244	5516	3.441	2.496	1.395	6.17
50	2800	8670.17	0.00003850	15.920	0.136417	3.1844	5516	3.441	2.496	1.395	6.17
50	2850	8819.17	0.00003850	15.920	0.136417	3.2444	5516	3.441	2.496	1.395	6.17
50	2900	8968.17	0.00003850	15.920	0.136417	3.3044	5516	3.441	2.496	1.395	6.17
50	2950	9117.17	0.00003850	15.920	0.136417	3.3644	5516	3.441	2.496	1.395	6.17
50	3000	9266.17	0.00003850	15.920	0.136417	3.4244	5516	3.441	2.496	1.395	6.17
50	3050	9415.17	0.00003850	15.920	0.136417	3.4844	5516	3.441	2.496	1.395	6.17
50	3100	9564.17	0.00003850	15.920	0.136417	3.5444	5516	3.441	2.496	1.395	6.17
50	3150	9713.17	0.00003850	15.920	0.136417	3.6044	5516	3.441	2.496	1.395	6.17
50	3200	9862.17	0.00003850	15.920	0.136417	3.6644	5516	3.441	2.496	1.395	6.17
50	3250	10011.17	0.00003850	15.920	0.136417	3.7244	5516	3.441	2.496	1.395	6.17
50	3300	10160.17	0.00003850	15.920	0.136417	3.7844	5516	3.441	2.496	1.395	6.17
50	3350	10309.17	0.00003850	15.920	0.136417	3.8444	5516	3.441	2.496	1.395	6.17
50	3400	10458.17	0.00003850	15.920	0.136417	3.9044	5516	3.441	2.496	1.395	6.17
50	3450	10607.17	0.00003850	15.920	0.136417	3.9644	5516	3.441	2.496	1.395	6.17
50	3500	10756.17	0.00003850	15.920	0.136417	4.0244	5516	3.441	2.496	1.395	6.17
50	3550	10905.17	0.00003850	15.920	0.136417	4.0844	5516	3.441	2.496	1.395	6.17
50	3600	11054.17	0.00003850	15.920	0.136417	4.1444	5516	3.441			

# PARAMHYDROGEN (OUTPUT FROM PT PROGRAMS)

PRESSURE PSIA	TEMPERATURE DEG. R	ENTHALPY BTU/LB	DENSITY LB/CU.FT	ENTROPY BTU/LB-R	CONDUCTIVITY BTU/H - FT-R	VISCOSITY LB-H/ SQ.FT *10**13	VEL.SOUND FT/S	C-P BTU/LB-R	C-V BTU/LB-R	CP/CV RATIO	L FACTOR
150	25	-152.40	4.8529367	1.184	0.044715	1.5158	4250	1.550	1.141	1.367	1535
150	30	-119.12	4.7019630	1.466	0.053909	1.1558	4043	1.500	1.240	1.451	2374
150	35	-109.27	4.5408212	1.767	0.057764	0.8085	3816	1.500	1.338	1.576	2560
150	40	-97.74	4.3510571	2.079	0.060150	0.7169	3581	2.481	1.412	1.754	3357
150	45	-84.31	4.1541375	2.393	0.059804	0.5825	3285	2.979	1.462	2.038	3593
150	50	-66.76	3.7784168	2.782	0.056825	0.4735	2882	3.810	1.499	2.542	4117
150	55	-43.96	3.3386465	3.209	0.050925	0.2803	2285	6.419	1.561	4.113	5116
150	60	92.33	0.7136857	5.556	0.021852	0.1264	1347	9.674	1.773	3.232	4717
150	65	115.75	0.5762403	5.954	0.020975	0.1300	1487	4.120	1.605	2.607	3977
150	70	134.88	0.4986615	6.261	0.021231	0.1316	1590	3.568	1.571	2.271	3727
150	75	152.61	0.4433508	6.501	0.021818	0.1358	1676	3.290	1.547	2.137	3507
150	80	168.61	0.4119304	6.766	0.022480	0.1416	1755	3.119	1.537	2.029	3275
150	85	183.93	0.3692396	6.895	0.023493	0.1474	1821	3.022	1.535	1.908	3026
150	90	197.96	0.3430227	7.070	0.024373	0.1532	1888	2.928	1.535	1.808	2809
150	95	212.40	0.3196242	7.214	0.025301	0.1593	1944	2.837	1.542	1.828	2549
150	100	226.85	0.2998829	7.359	0.027386	0.1649	2001	2.740	1.551	1.884	2300
150	110	255.59	0.2680677	7.638	0.029025	0.1762	2101	2.437	1.584	1.768	2000
150	120	283.78	0.2427220	7.877	0.030965	0.1875	2204	2.836	1.634	1.717	1751
150	130	312.17	0.2220253	8.107	0.033200	0.1985	2270	2.451	1.707	1.670	1549
150	140	340.87	0.2047742	8.320	0.035836	0.2093	2363	2.314	1.796	1.623	1344
150	150	370.38	0.1901492	8.522	0.038383	0.2192	2403	2.377	1.905	1.580	1107
150	160	400.43	0.1775102	8.719	0.044433	0.2292	2457	3.076	1.995	1.542	9166
150	170	430.89	0.1665356	8.933	0.047612	0.2420	2564	3.272	2.105	1.508	4325
150	180	461.39	0.1570500	9.146	0.050749	0.2511	2664	3.476	2.216	1.477	4494
150	190	498.41	0.1487750	9.311	0.053886	0.2604	2764	3.673	2.331	1.452	4646
150	200	535.44	0.1405000	9.477	0.056971	0.2694	2864	3.876	2.441	1.431	4799
150	250	720.57	0.1102530	10.364	0.059571	0.3061	3200	3.876	2.524	1.396	5340
150	300	909.48	0.0911625	10.998	0.060494	0.3471	3177	3.876	2.591	1.366	6192
150	350	1104.09	0.0782813	11.626	0.061975	0.3862	3433	3.876	2.648	1.341	5921
150	400	1296.65	0.0685934	12.129	0.063668	0.4227	3688	3.876	2.771	1.359	5319
150	450	1481.03	0.0610312	12.568	0.065648	0.4577	3922	3.673	2.888	1.366	5427
150	500	1655.55	0.0559525	12.965	0.068140	0.4919	4143	3.595	2.606	1.340	5789
150	550	1840.05	0.0513225	13.240	0.070960	0.5209	4361	3.553	2.524	1.345	5827
150	600	2044.54	0.0466925	13.515	0.074884	0.5500	4559	3.511	2.524	1.391	5475
150	700	2363.53	0.0400550	14.065	0.080950	0.6664	5272	3.476	2.485	1.396	5340
150	800	2712.53	0.0350750	14.615	0.082504	0.7246	5551	3.476	2.491	1.396	6192
150	900	3061.52	0.0311975	14.983	0.084352	0.7827	5830	3.476	2.497	1.395	6192
150	1000	3410.51	0.0280925	15.352	0.086200	0.8055	6527	3.495	2.511	1.392	6192
150	1250	4282.57	0.0224883	16.140	0.094000	0.9055	7162	3.524	2.539	1.388	6540
150	1500	5156.63	0.0186856	16.788	0.104000	1.0284	8242	3.574	2.589	1.380	6782
150	1750	6046.83	0.0160717	17.342	0.113900	1.1390	9134	3.624	2.639	1.373	7195
150	2000	6936.23	0.0140794	17.830	0.124970	1.2497	8690	3.694	2.709	1.364	7317
150	2250	7862.59	0.0125101	18.210	0.136930	1.3524	9951	3.764	2.779	1.354	7409
150	2500	8786.54	0.0111944	18.590	0.149583	1.4551	9134	3.836	2.852	1.345	7375
150	2750	9754.77	0.0102886	18.970	0.162655	1.5514	9942	3.912	2.927	1.337	8086
150	3000	10720.00	0.0093429	19.350	0.176458	1.6477	10322	3.993	3.012	1.328	8357
150	3250	11710.83	0.0086793	19.646	0.190558	1.7395	10660	4.105	3.114	1.318	9228
150	3500	12701.67	0.0080156	19.942	0.205233	1.8344	10988	4.240	3.242	1.304	9188
150	3750	13765.00	0.0075160	20.239	0.220833	1.9394	11287	4.408	3.453	1.294	9749
150	4000	14824.13	0.0070163	20.535	0.236933	2.0397	11564	4.762	3.723	1.270	10669
150	4250	16024.17	0.0066229	20.833	0.253633	2.1433	11824	5.224	4.145	1.251	11388
150	4500	17220.00	0.0062294	21.130	0.271183	2.2537	12059	5.893	4.737	1.244	14549
150	4750	18780.83	0.0059066	21.427	0.289833	2.3637	12244	6.649	5.443	1.229	17111
150	5000	20181.67	0.0055838	21.725	0.309208	2.4615	12552	7.931	6.679	1.147	21310
150	5250	21601.67	0.0053064	22.157	0.329333	2.5593	12803	9.387	7.943	1.142	25019
150	5500	23181.00	0.0050298	22.590	0.350433	2.6659	13089	11.154	9.274	1.124	31721
150	5750	24821.67	0.0047813	23.022	0.372655	2.7725	13381	12.915	10.976	1.177	37334
150	6000	26563.33	0.0045328	23.455	0.394583	3.208033					



PAPAHYDROGEN (OUTPUT FROM PT PROGRAMS)

PSIA	TEMP. °F	ENTHALPY BTU/LB	DENSITY LB/CO.FT	ENTROPY BTU/LB-°F	CONDUCTIVITY BTU/M-°F-°F	VISCOSITY LB-FT/CO.FT *10 <sup>-10</sup>	VEL. SOUND FT/S	C-P BTU/LB-°F	C-V BTU/LB-°F	CH/CV RATIO	L FACTOR
500	25	-139.74	4.9339590	1.181	0.048684	1.5708	4450	1.553	1.171	1.327	1359
500	30	-128.02	4.9360195	1.385	0.050883	1.3443	4342	1.715	1.236	1.398	1360
500	35	-98.78	4.990388	1.670	0.061972	1.1334	4164	1.976	1.330	1.486	2423
500	40	-66.18	4.9401384	1.953	0.084549	0.8374	3974	2.257	1.404	1.638	2877
500	45	-76.10	4.3757578	2.235	0.085639	0.6954	3772	2.572	1.457	1.765	3233
500	50	-62.30	4.1496206	2.531	0.064735	0.5839	3529	2.943	1.495	1.968	3581
500	55	-40.40	3.9070313	2.831	0.062008	0.5014	3260	3.404	1.520	2.240	4155
500	60	-28.20	3.6066790	3.149	0.057727	0.4271	2943	4.035	1.541	2.619	4750
500	65	-5.89	3.2640811	3.521	0.052670	0.3629	2593	4.941	1.504	3.152	4959
500	70	21.80	2.8084677	3.924	0.048123	0.3074	2254	6.107	1.504	3.811	5377
500	75	54.47	2.3106333	4.370	0.043237	0.2561	2016	6.772	1.623	4.171	5502
500	80	96.70	1.8955637	4.769	0.038723	0.2269	1937	6.020	1.623	3.709	5309
500	85	114.93	1.6003967	5.123	0.036154	0.2107	1959	5.830	1.613	3.227	4941
500	90	142.83	1.4008329	5.420	0.034304	0.2034	1940	4.572	1.604	2.850	4625
500	95	160.44	1.2519333	5.621	0.034204	0.1997	2028	4.262	1.606	2.615	4455
500	100	180.04	1.1366355	5.822	0.034012	0.1986	2076	3.847	1.610	2.401	4309
500	110	218.16	0.9751344	6.201	0.035454	0.2026	2175	3.516	1.633	2.154	4214
500	120	251.94	0.8761771	6.491	0.036236	0.2089	2252	3.334	1.675	1.991	4119
500	130	285.13	0.7830771	6.761	0.037434	0.2163	2324	3.262	1.739	1.876	4142
500	140	317.44	0.6936793	7.000	0.038543	0.2251	2396	3.253	1.822	1.745	4155
500	150	343.91	0.627857	7.224	0.040275	0.2355	2468	3.243	1.908	1.641	4277
500	160	382.51	0.5555864	7.434	0.043373	0.2422	2526	3.207	2.009	1.641	4410
500	170	416.72	0.5555336	7.666	0.047893	0.2503	2582	3.171	2.113	1.544	4555
500	180	451.30	0.5235001	7.876	0.051004	0.2575	2640	3.135	2.217	1.549	4666
500	190	449.11	0.4959167	8.046	0.054093	0.2663	2693	3.095	2.326	1.515	4717
500	200	526.33	0.4683333	8.213	0.057133	0.2751	2739	3.053	2.438	1.483	4848
500	250	716.00	0.3575007	9.051	0.072346	0.3161	3001	2.871	2.871	1.348	5554
500	300	908.21	0.3338790	9.792	0.082730	0.3574	3259	2.617	2.964	1.353	5445
500	350	1105.11	0.2603375	10.394	0.091232	0.3941	3509	2.307	2.876	1.358	5362
500	400	1299.80	0.2284654	10.949	0.103693	0.4285	3761	2.074	2.744	1.304	5307
500	450	1485.63	0.2034375	11.367	0.102413	0.4621	3992	1.794	2.699	1.372	5452
500	500	1671.50	0.1825700	11.785	0.107567	0.4946	4215	1.534	2.614	1.332	5812
500	550	1846.22	0.1576625	12.061	0.113430	0.5224	4426	1.357	2.572	1.347	5838
500	600	2020.94	0.1527550	12.377	0.119283	0.5511	4621	1.521	2.530	1.392	5873
500	700	2370.58	0.1313570	12.688	0.131020	0.6076	4988	1.447	2.499	1.395	5944
500	800	2719.42	0.1152560	13.440	0.142747	0.6643	5326	1.473	2.487	1.337	6116
500	900	3069.26	0.1026560	13.808	0.154473	0.7205	5603	1.474	2.492	1.306	6107
500	1000	3414.70	0.0925550	14.177	0.166203	0.7773	5873	1.444	2.498	1.316	6158
500	1250	4290.90	0.0742925	14.964	0.194000	0.8973	6571	1.437	2.511	1.392	6343
500	1500	5163.10	0.0518445	15.617	0.221800	1.0175	7201	1.524	2.539	1.344	6524
500	1750	6055.10	0.0532503	16.167	0.249750	1.1213	7734	1.574	2.569	1.340	6793
500	2000	6947.10	0.0466770	16.650	0.277700	1.2350	8275	1.624	2.639	1.373	7157
500	2250	7826.95	0.0415014	17.033	0.306803	1.3358	8721	1.694	2.709	1.364	7551
500	2500	8734.80	0.0372984	17.415	0.336067	1.4367	9147	1.764	2.779	1.355	7945
500	2750	9762.40	0.0342154	17.797	0.371650	1.5313	9579	1.835	2.850	1.346	8337
500	3000	10730.00	0.0311323	18.180	0.393833	1.5920	9969	1.904	2.923	1.337	8718
500	3250	11715.00	0.0289219	18.473	0.425117	1.7103	10350	1.983	2.997	1.329	9105
500	3500	12700.00	0.0267116	18.765	0.456403	1.8067	10693	2.067	3.079	1.321	9493
500	3750	13740.00	0.0250445	19.054	0.487803	1.8955	11036	2.153	3.171	1.313	9879
500	4000	14780.00	0.0233855	19.350	0.519200	1.9803	11336	2.240	3.269	1.305	10257
500	4250	15903.33	0.0220793	19.620	0.608217	2.0658	11668	2.328	3.364	1.292	10637
500	4500	17026.67	0.0207732	19.890	0.677233	2.1513	11899	2.417	3.459	1.279	10799
500	4750	18301.67	0.0197033	20.160	0.802200	2.2395	12147	2.511	3.551	1.265	12131
500	5000	19576.67	0.0186434	20.430	0.927167	2.3277	12396	2.603	3.642	1.252	13664
500	5250	21128.33	0.0177333	20.759	1.143583	2.4133	12645	2.692	3.738	1.239	15751
500	5500	22680.00	0.0168352	21.087	1.360003	2.5010	12897	2.779	3.834	1.229	18358
500	5750	24666.67	0.0160322	21.416	1.701167	2.6108	13161	2.864	3.921	1.221	21373
500	6000	26653.33	0.0152293	21.745	2.042333	2.7107	13473	2.951	4.008	1.217	24318

# PARAMYDROGEN (OUTPUT FROM PT PROGRAMS)

PRESSURE PSIA	TEMPERATURE DEG. F	ENTHALPY BTU/LB	DENSITY LB/CU.FT	ENTROPY BTU/LB-R	CONDUCTIVITY BTU/M -FT-R	VISCOSITY LB-M /SQ.FT *10**10	VEL.SOUND FT/S	C-P BTU/LB-P	C-V BTU/LB-R	CP/CV RATIO	I FACTOR
1500	25	-104.56	5.1546222	1.199	0.060313	1.9612	4925	1.559	1.212	1.287	1580
1500	30	-104.56	5.1543206	.219	0.061016	1.9179	4925	1.553	1.212	1.287	1701
1500	35	-87.76	5.0271414	1.473	0.068128	1.4508	4835	1.759	1.299	1.354	2160
1500	40	-58.40	4.8999621	1.717	0.073029	1.1743	4737	1.968	1.378	1.428	2581
1500	45	-48.04	4.7727824	1.959	0.076766	0.9808	4603	2.166	1.435	1.510	2946
1500	50	-36.70	4.6456035	2.200	0.078833	0.8471	4468	2.365	1.491	1.586	3264
1500	55	-24.40	4.5122807	2.439	0.077409	0.7432	4334	2.556	1.524	1.677	3537
1500	60	-11.14	4.3539517	2.666	0.075723	0.6559	4199	2.747	1.554	1.767	3765
1500	65	3.05	4.1956944	2.892	0.073408	0.5937	4052	2.931	1.576	1.859	3944
1500	70	18.14	4.0374378	3.119	0.071092	0.5416	3905	3.104	1.585	1.958	4122
1500	75	34.08	3.8667813	3.338	0.068516	0.4985	3758	3.277	1.595	2.055	4256
1500	80	50.03	3.6974546	3.551	0.065940	0.4558	3611	3.421	1.604	2.133	4389
1500	85	68.33	3.5089358	3.764	0.063627	0.4244	3502	3.562	1.613	2.209	4491
1500	90	86.47	3.3300131	3.978	0.061314	0.3953	3392	3.677	1.623	2.266	4594
1500	95	105.58	3.1622829	4.170	0.059472	0.3752	3283	3.748	1.637	2.290	4640
1500	100	124.52	2.9945528	4.363	0.057380	0.3600	3173	3.819	1.650	2.314	4712
1500	110	162.58	2.6738837	4.737	0.055566	0.3422	3079	3.824	1.683	2.275	4725
1500	120	200.68	2.4123798	5.063	0.053712	0.3314	2984	3.792	1.728	2.195	4738
1500	130	238.44	2.1796805	5.369	0.053500	0.3053	2932	3.748	1.792	2.091	4722
1500	140	275.69	1.9901083	5.646	0.054923	0.2972	2952	3.692	1.877	1.982	4767
1500	150	312.78	1.8314030	5.902	0.056558	0.2979	2933	3.627	1.962	1.841	4794
1500	160	349.75	1.6933089	6.144	0.058768	0.3011	2934	3.737	2.054	1.835	4822
1500	170	387.13	1.5818402	6.434	0.060910	0.3038	2934	3.733	2.147	1.734	4894
1500	180	424.67	1.4858157	6.592	0.063657	0.3068	3016	3.739	2.239	1.670	5090
1500	190	464.61	1.4055000	6.773	0.066405	0.3186	3046	3.812	2.353	1.620	5205
1500	200	504.54	1.3255833	6.953	0.069042	0.3358	3075	3.885	2.467	1.575	5319
1500	250	704.21	1.0417167	7.855	0.0930142	0.3869	3281	4.137	2.861	1.436	5442
1500	300	905.30	0.8640583	8.642	0.088379	0.4163	3508	4.435	3.016	1.378	6049
1500	350	1108.52	0.7442556	9.255	0.095587	0.4452	3741	4.814	2.916	1.376	6375
1500	400	1302.06	0.6540139	9.830	0.100582	0.4739	3980	5.372	2.817	1.375	5994
1500	450	1498.89	0.5836250	10.255	0.105075	0.5023	4200	5.763	2.726	1.381	5320
1500	500	1688.50	0.5258530	10.630	0.109300	0.5282	4414	6.355	2.635	1.387	5838
1500	550	1863.86	0.4840750	10.958	0.114990	0.5541	4603	6.800	2.590	1.390	5467
1500	600	2039.22	0.4423000	11.235	0.120680	0.5860	5156	7.502	2.544	1.396	5955
1500	700	2389.94	0.3819500	11.730	0.132060	0.6578	5484	8.482	2.492	1.397	6014
1500	800	2748.66	0.3363000	12.345	0.143440	0.7097	5864	9.482	2.436	1.396	6073
1500	900	3091.38	0.3004500	12.713	0.154820	0.7615	6024	10.499	2.501	1.395	6132
1500	1000	3442.10	0.2715000	13.082	0.166200	0.8148	6204	11.499	2.512	1.393	6313
1500	1250	4316.70	0.2192500	13.873	0.194000	0.8748	6700	13.499	2.539	1.388	6495
1500	1500	5187.30	0.1833500	14.523	0.221800	0.9880	7317	15.908	2.589	1.381	6822
1500	1750	6079.30	0.1581188	15.077	0.243750	1.1930	7845	18.374	2.638	1.373	7149
1500	2000	6971.30	0.1387725	15.560	0.277730	1.3840	8374	20.823	2.708	1.364	7448
1500	2250	7894.85	0.1235213	15.941	0.306750	1.5885	8914	23.255	2.778	1.355	7748
1500	2500	8810.40	0.1111950	16.323	0.335800	1.8043	9255	25.633	2.848	1.346	8048
1500	2750	9784.20	0.1020625	16.704	0.360750	2.0410	9663	28.000	2.919	1.337	8348
1500	3000	10750.00	0.0929300	17.085	0.393500	2.2985	10050	30.304	2.989	1.330	8649
1500	3250	11735.00	0.0833450	17.376	0.423550	2.5600	10430	32.574	3.067	1.322	8949
1500	3500	12720.00	0.0797600	17.667	0.453600	2.8360	10779	34.845	3.157	1.314	9249
1500	3750	13750.00	0.0748250	17.959	0.483400	3.1185	11128	37.119	3.247	1.306	9549
1500	4000	14780.00	0.0698900	18.250	0.525200	3.4085	11545	39.353	3.361	1.298	9849
1500	4250	15870.00	0.0660125	18.506	0.568500	3.6850	11953	41.590	3.456	1.287	10348
1500	4500	16960.00	0.0621350	18.762	0.628500	4.0600	12346	43.816	3.566	1.277	10748
1500	4750	18145.00	0.0588825	19.014	0.698500	4.4743	12740	46.042	3.672	1.268	11148
1500	5000	19330.00	0.0558300	19.275	0.779500	4.9240	13134	48.268	3.778	1.259	11548
1500	5250	20505.00	0.0531750	19.550	0.863500	5.4000	13528	50.494	3.884	1.250	11948
1500	5500	22040.00	0.0505200	19.825	0.953500	5.9000	13922	52.720	3.990	1.241	12348
1500	5750	23650.00	0.0481925	20.100	1.048500	6.4250	14316	54.946	4.096	1.232	12748
1500	6000	25260.00	0.0458650	20.375	1.149000	6.9750	14710	57.172	4.202	1.223	13148

PARAHYDROGEN (OUTPUT FROM PT PROGRAMS)

PSIA	TEMPERATURE DEG. R	ENTHALPY BTU/LB	DENSITY LB/CU.FT	ENTROPY BTU/LB-R	CONDUCTIVITY BTU/IN-FT-R	VISCOSITY LB-FT/IN-SEC *10 <sup>-4</sup>	VEL.SOUND FT/SEC	C-P BTU/LB-R	C-V BTU/LB-R	CP/CV RATIO	L FACTOR
4500	25	-5.75	5.5473082	1.318	0.090831	2.3113	6549	1.555	1.339	1.244	2.777
4500	30	-5.75	5.5473082	1.318	0.090831	2.3113	6549	1.555	1.339	1.244	2.777
4500	35	-5.75	5.5473082	1.318	0.090831	2.3113	6549	1.555	1.339	1.244	2.777
4500	40	32.38	5.5323171	1.354	0.092290	2.2159	6044	1.684	1.334	1.244	2.777
4500	45	41.30	5.4485682	1.555	0.098312	1.8054	5980	1.825	1.417	1.248	2.705
4500	50	50.84	5.3648132	1.757	0.101876	1.5407	5915	1.969	1.487	1.324	2.607
4500	55	58.91	5.2810733	1.954	0.103472	1.3480	5851	2.088	1.532	1.362	2.509
4500	60	71.66	5.1973214	2.134	0.103212	1.1935	5787	2.205	1.576	1.400	2.404
4500	65	83.05	5.1135724	2.315	0.102768	1.0944	5713	2.314	1.612	1.435	2.342
4500	70	94.85	5.0298235	2.495	0.101115	1.0044	5640	2.404	1.637	1.471	2.286
4500	75	107.10	4.9409797	2.664	0.099564	0.9355	5566	2.532	1.652	1.505	2.226
4500	80	119.49	4.8487333	2.825	0.097903	0.8705	5493	2.582	1.641	1.536	2.160
4500	85	132.48	4.7564949	2.986	0.096164	0.8134	5420	2.550	1.700	1.564	2.094
4500	90	146.37	4.6625456	3.147	0.094435	0.7703	5346	2.735	1.719	1.531	2.034
4500	95	160.69	4.5720142	3.292	0.092738	0.7255	5273	2.803	1.736	1.514	1.978
4500	100	175.00	4.4797779	3.437	0.091282	0.6963	5199	2.872	1.754	1.537	1.920
4500	110	204.05	4.2978363	3.721	0.089011	0.5785	5122	2.984	1.771	1.558	1.863
4500	120	234.75	4.1260553	3.948	0.086720	0.4944	5045	3.309	1.819	1.585	1.805
4500	130	266.22	3.95842731	4.238	0.084550	0.4615	4968	3.213	1.904	1.586	1.747
4500	140	298.97	3.7824912	4.479	0.083393	0.4281	4891	3.320	1.986	1.572	1.689
4500	150	332.76	3.6282626	4.712	0.084511	0.4052	4809	3.431	2.068	1.539	1.631
4500	160	367.48	3.4857361	4.939	0.085042	0.4881	4740	3.523	2.153	1.536	1.574
4500	170	403.32	3.3432096	5.164	0.086142	0.4744	4670	3.615	2.238	1.515	1.516
4500	180	439.40	3.1933333	5.355	0.087185	0.4488	4601	3.708	2.324	1.596	1.458
4500	190	475.00	3.0452222	5.532	0.088092	0.4261	4531	3.814	2.409	1.563	1.400
4500	200	521.17	2.9711111	5.709	0.089497	0.4044	4461	3.920	2.555	1.534	1.342
4500	250	725.60	2.4978344	6.594	0.100525	0.4684	4264	4.276	2.985	1.432	1.177
4500	300	932.52	2.1500000	7.380	0.101956	0.4755	4355	4.334	3.120	1.369	1.119
4500	350	1143.19	1.8950000	8.615	0.104300	0.5622	4635	4.168	3.005	1.347	1.061
4500	400	1350.62	1.6939444	8.613	0.110000	0.4942	4567	4.302	2.800	1.385	1.003
4500	450	1545.08	1.5322500	9.051	0.112037	0.5090	4447	3.870	2.786	1.389	0.945
4500	500	1739.50	1.4504500	9.817	0.114503	0.5204	4324	3.730	2.643	1.394	0.887
4500	550	1916.78	1.3423500	9.598	0.119670	0.5453	5197	3.570	2.628	1.396	0.829
4500	600	2094.06	1.2342500	9.474	0.124940	0.5653	5361	3.501	2.574	1.399	0.771
4500	700	2448.62	1.0755500	10.439	0.135130	0.6045	5673	3.587	2.528	1.400	0.613
4500	800	2803.18	0.9536000	11.500	0.145570	0.6440	5967	3.507	2.507	1.398	0.555
4500	900	3157.74	0.8567000	11.370	0.155460	0.6835	6219	3.507	2.509	1.397	0.497
4500	1000	3512.30	0.7779500	11.740	0.165260	0.7231	6470	3.507	2.511	1.397	0.439
4500	1250	4386.10	0.6336250	12.530	0.134000	0.4173	7099	3.507	2.517	1.393	0.381
4500	1500	5259.90	0.5332000	13.150	0.221800	0.9127	7677	3.526	2.539	1.348	0.324
4500	1750	6151.90	0.4617500	13.737	0.249750	1.3009	8181	3.574	2.588	1.341	0.266
4500	2000	7043.90	0.4366750	14.220	0.277750	1.3009	8684	3.522	2.637	1.374	0.208
4500	2250	7966.55	0.3630000	14.600	0.303350	1.1695	9103	3.632	2.706	1.354	0.150
4500	2500	8889.20	0.3273000	14.980	0.335000	1.2500	9533	3.761	2.776	1.355	0.092
4500	2750	9849.60	0.3008250	15.360	0.350050	1.3280	9927	3.833	2.845	1.346	0.034
4500	3000	10810.00	0.2743500	15.740	0.394300	1.4063	10301	3.927	2.913	1.338	0.000
4500	3250	11795.00	0.2553500	16.022	0.422350	1.4800	10669	4.039	2.942	1.321	0.000
4500	3500	12780.00	0.2363500	16.325	0.451400	1.5540	11011	4.039	3.002	1.323	0.000
4500	3750	13810.00	0.2217925	16.617	0.482700	1.6255	11354	4.112	3.123	1.317	0.000
4500	4000	14840.00	0.2072350	16.910	0.514000	1.6970	11672	4.186	3.195	1.310	0.000
4500	4250	15900.00	0.1959525	17.156	0.551750	1.7665	11984	4.274	3.278	1.304	0.000
4500	4500	16950.00	0.1846700	17.403	0.589500	1.8360	12282	4.317	3.410	1.295	0.000
4500	4750	18075.00	0.1744400	17.649	0.624500	1.9035	12560	4.360	3.541	1.287	0.000
4500	5000	19190.00	0.1662100	17.895	0.659500	1.9710	12838	4.403	3.673	1.279	0.000
4500	5250	20385.00	0.1583500	18.126	0.764850	2.0370	13086	5.002	3.938	1.270	0.000
4500	5500	21580.00	0.1507400	18.358	0.838200	2.1030	13335	5.302	4.204	1.261	0.000
4500	5750	22890.00	0.1441425	18.589	0.944600	2.1695	13574	5.601	4.469	1.253	0.000
4500	6000	24200.00	0.1375450	18.820	1.051000	2.2360	13816	6.003	4.800	1.251	0.000

## EQUILIBRIUM HYDROGEN (OUTPUT FROM ET PROGRAMS)

PRESSURE PSIA	TEMPERATURE DEG. R	ENTHALPY BTU/LB	DENSITY LB/CU.FT	ENTROPY BTU/LB-R	CONDUCTIVITY BTU/H -FT-R	VISCOSITY LB-H /SQ.FT *10**10	VEL-SOUND FT/S	C-P BTU/LE-R	C-V BTU/LB-R	CP/CV RATIO	L FACTOR
1	25	60.63	0.0075644	0.995	0.007202	0.0449	1000	2.535	1.497	1.705	2613
1	30	73.35	0.0063539	9.436	0.008148	0.0532	1097	2.536	1.521	1.668	2642
1	35	86.14	0.0054165	9.029	0.009094	0.0615	1180	2.584	1.594	1.621	2672
1	40	99.35	0.0047232	16.175	0.010875	0.0698	1246	2.702	1.726	1.566	2875
1	45	113.32	0.0041080	10.522	0.012065	0.0781	1299	2.893	1.921	1.506	3121
1	50	128.69	0.0037698	10.849	0.013581	0.0864	1341	3.125	2.152	1.452	3437
1	55	145.22	0.0034268	11.163	0.015193	0.0946	1379	3.450	2.464	1.400	3799
1	60	163.16	0.0031400	11.478	0.021074	0.1020	1419	3.740	2.749	1.360	4146
1	65	182.47	0.0028977	11.781	0.024027	0.1095	1459	4.006	3.016	1.328	4470
1	70	202.94	0.0026892	12.079	0.026912	0.1169	1500	4.191	3.202	1.309	4772
1	75	224.22	0.0025123	12.378	0.029535	0.1239	1545	4.342	3.354	1.295	4988
1	80	246.10	0.0023508	12.653	0.032141	0.1307	1591	4.445	3.457	1.286	5210
1	85	268.54	0.0022136	12.925	0.034320	0.1375	1638	4.483	3.494	1.283	5335
1	90	291.34	0.0020914	13.155	0.036178	0.1443	1684	4.505	3.515	1.281	5407
1	95	313.32	0.0019799	13.390	0.037747	0.1505	1733	4.464	3.475	1.285	5437
1	100	335.31	0.0018805	13.625	0.039942	0.1570	1781	4.416	3.427	1.288	5430
1	110	378.77	0.0017185	14.064	0.043768	0.1681	1878	4.258	3.271	1.302	5330
1	120	429.17	0.0015739	14.382	0.047493	0.1809	1975	4.081	3.093	1.313	5230
1	130	480.33	0.0014530	14.699	0.051334	0.1921	2068	3.914	2.929	1.336	5084
1	140	530.62	0.0013465	15.017	0.054172	0.2031	2162	3.763	2.777	1.355	4937
1	150	585.44	0.0012549	15.275	0.056512	0.2138	2255	3.612	2.626	1.375	4837
1	160	641.28	0.0011773	15.494	0.058670	0.2242	2340	3.452	2.454	1.389	4737
1	170	693.70	0.0011071	15.714	0.060690	0.2337	2425	3.335	2.242	1.404	4667
1	180	749.01	0.0010470	15.940	0.062910	0.2434	2510	3.250	2.051	1.426	4599
1	190	801.83	0.0009918	16.086	0.064936	0.2541	2585	3.149	1.849	1.448	4501
1	200	854.65	0.0009367	16.232	0.066809	0.2648	2660	3.048	1.644	1.472	4401
1	250	1084.73	0.0007350	16.964	0.075050	0.3007	2990	2.545	1.259	1.438	4601
1	300	1321.61	0.0006077	17.535	0.086582	0.3427	3266	1.919	0.849	1.455	4614
1	350	1582.69	0.0005219	18.047	0.097538	0.3829	3516	1.245	0.549	1.447	4782
1	400	1855.12	0.0004573	18.485	0.0084549	0.4202	3749	0.848	0.314	1.426	5174
1	450	2132.98	0.0004069	18.877	0.0093097	0.4559	3959	0.485	0.2363	1.417	5340
1	500	2401.02	0.0003747	19.250	0.010402	0.4906	4185	0.397	0.2412	1.408	5517
1	550	2653.62	0.0003436	19.510	0.0107871	0.5201	4352	0.348	0.2433	1.405	5585
1	600	2826.22	0.0003125	19.780	0.0114341	0.5495	4551	0.308	0.2453	1.402	5654
1	700	3371.62	0.0002679	20.320	0.0127280	0.5854	4912	0.245	0.2476	1.398	5927
1	800	3716.82	0.0002345	20.860	0.0140219	0.6284	5250	0.200	0.2470	1.397	6083
1	900	3861.82	0.0002085	21.227	0.015158	0.6763	5530	0.168	0.2490	1.396	6199
1	1000	3981.02	0.0001877	21.593	0.0160897	0.7252	5810	0.145	0.2507	1.393	6371
1	1250	4279.02	0.0001505	22.305	0.0193896	0.9091	6509	0.091	0.2538	1.388	6543
1	1500	5151.02	0.0001252	23.037	0.021694	1.0330	7145	0.054	0.2589	1.381	6784
1	1750	6043.02	0.0001076	23.587	0.0243697	1.1445	7686	0.037	0.2639	1.373	7024
1	2000	6935.02	0.0000942	24.070	0.0277700	1.2560	8227	0.027	0.2694	1.364	7308
1	2250	7859.02	0.0000837	24.480	0.0306900	1.3595	8673	0.022	0.2709	1.354	7592
1	2500	8783.02	0.0000752	24.890	0.0336100	1.4630	9120	0.018	0.2779	1.342	7972
1	2750	9751.52	0.0000669	25.245	0.0373397	1.5660	9515	0.015	0.2861	1.328	8353
1	3000	10720.00	0.0000607	25.500	0.0410700	1.6570	9877	0.013	0.3026	1.328	8735
1	3250	11757.50	0.0000552	25.600	0.0440700	1.7400	10213	0.011	0.3132	1.304	9196
1	3500	12808.00	0.0000506	25.935	0.0467000	1.8150	10445	0.009	0.3182	1.272	9639
1	3750	14237.50	0.0000465	26.270	0.0493750	1.8830	10677	0.008	0.3245	1.235	10139
1	4000	15980.00	0.0000429	30.790	0.0529000	2.0000	10845	0.007	0.3312	1.179	10639
1	4250	18267.50	0.0000399	27.725	0.0563500	2.1250	11004	0.006	0.3382	1.121	11134
1	4500	21085.00	0.0000370	28.380	0.0598000	2.2500	11128	0.005	0.3454	1.073	11634
1	4750	26337.50	0.0000364	29.585	0.0632500	2.3750	11268	0.004	0.3526	1.025	12134
1	5000	32960.00	0.0000329	30.790	0.0667000	2.5000	11408	0.003	0.3600	0.977	12634
1	5250	42359.99	0.0000299	32.805	0.0701500	2.6250	11548	0.002	0.3674	0.929	13134
1	5500	54329.99	0.0000256	34.820	0.0736000	2.7500	11688	0.001	0.3748	0.881	13634
1	5750	68294.99	0.0000226	37.325	0.0770500	2.8750	11828	0.001	0.3822	0.833	14134
1	6000	82919.99	0.0000195	39.830	0.0805000	3.0000	11968	0.000	0.3896	0.785	14634

## EQUILIBRIUM HYDROGEN (OUTPUT FROM ET PROGRAMS)

PSIA	TEMPERATURE DEG. R	ENTHALPY BTU/LB	DENSITY LB/CU.FT	ENTROPY BTU/LB-R	CONDUCTIVITY BTU/H-FT-R	VISCOSITY LB-H/50-FT *10 <sup>-6</sup>	VEL SOUND FT/S	C-F BTU/LF-R	C-V BTU/LF-R	CR/CL RATIO	I FACTOR
15	25	-132.68	4.8165105	1.190	0.043185	1.4436	4188	1.567	1.143	1.302	1537
15	30	-123.26	4.6443963	1.509	0.053150	1.0638	3881	1.877	1.274	1.473	2143
15	35	-112.70	4.4722821	1.829	0.065593	0.8333	3637	2.313	1.443	1.595	2683
15	40	91.59	0.0768321	7.427	0.011477	0.0719	1193	3.044	1.778	1.712	3067
15	45	106.63	0.0667821	7.788	0.013347	0.0800	1253	3.172	1.958	1.620	3262
15	50	123.25	0.0590916	8.127	0.015762	0.0880	1304	3.321	2.174	1.527	3542
15	55	140.64	0.0530733	8.453	0.018540	0.0960	1351	3.594	2.483	1.449	3880
15	60	159.24	0.0482165	8.779	0.021381	0.1033	1396	3.848	2.761	1.394	4209
15	65	179.00	0.0443642	9.090	0.024315	0.1106	1441	4.089	3.025	1.352	4523
15	70	199.81	0.0404964	9.396	0.027182	0.1179	1486	4.259	3.219	1.327	4817
15	75	221.40	0.0383351	9.702	0.029782	0.1249	1533	4.400	3.360	1.310	5027
15	80	243.56	0.0357877	9.979	0.032432	0.1316	1581	4.496	3.462	1.299	5252
15	85	266.24	0.03337205	10.252	0.034601	0.1383	1629	4.527	3.499	1.294	5370
15	90	289.08	0.0316321	10.480	0.037987	0.1450	1677	4.542	3.519	1.291	5437
15	95	311.25	0.0299067	10.718	0.039837	0.1512	1727	4.547	3.478	1.293	5463
15	100	333.43	0.0283662	10.955	0.039343	0.1577	1776	4.444	3.430	1.296	5455
15	105	355.61	0.0269785	11.190	0.041026	0.1648	1825	4.281	3.273	1.308	5350
15	110	377.23	0.0257886	11.427	0.042708	0.1715	1875	4.099	3.095	1.324	5246
15	115	400.85	0.0246160	11.671	0.044323	0.1782	1925	3.890	2.931	1.341	5097
15	120	425.97	0.0234601	11.919	0.045923	0.1849	1975	3.653	2.778	1.359	4949
15	125	452.12	0.0223185	12.168	0.047507	0.1916	2025	3.397	2.630	1.377	4802
15	130	479.62	0.0211801	12.418	0.049077	0.1983	2075	3.132	2.486	1.395	4655
15	135	507.62	0.0200485	12.668	0.050633	0.2050	2125	2.867	2.346	1.413	4508
15	140	536.56	0.0189223	12.918	0.052177	0.2117	2175	2.602	2.210	1.431	4361
15	145	566.46	0.0178015	13.168	0.053707	0.2184	2225	2.337	2.074	1.448	4214
15	150	596.34	0.0166755	13.418	0.055223	0.2251	2275	2.072	1.938	1.465	4067
15	155	626.61	0.0155500	13.668	0.056727	0.2318	2325	1.810	1.802	1.482	3920
15	160	656.46	0.0144245	13.918	0.058221	0.2385	2375	1.547	1.666	1.499	3773
15	165	686.34	0.0133000	14.168	0.059696	0.2452	2425	1.284	1.530	1.516	3626
15	170	716.23	0.0121755	14.418	0.061161	0.2519	2475	1.021	1.394	1.533	3479
15	175	746.12	0.0110500	14.668	0.062616	0.2586	2525	0.758	1.258	1.550	3332
15	180	776.01	0.0100000	14.918	0.064071	0.2653	2575	0.495	1.122	1.567	3185
15	185	805.90	0.0090000	15.168	0.065526	0.2720	2625	0.232	0.986	1.584	3038
15	190	835.79	0.0080000	15.418	0.066981	0.2787	2675	0.069	0.849	1.601	2891
15	195	865.68	0.0070000	15.668	0.068436	0.2854	2725		0.712	1.618	2744
15	200	895.57	0.0060000	15.918	0.069891	0.2921	2775		0.575	1.635	2597
15	205	925.46	0.0050000	16.168	0.071346	0.2988	2825		0.438	1.652	2450
15	210	955.35	0.0040000	16.418	0.072801	0.3055	2875		0.301	1.669	2303
15	215	985.24	0.0030000	16.668	0.074256	0.3122	2925		0.164	1.686	2156
15	220	1015.13	0.0020000	16.918	0.075711	0.3189	2975		0.027	1.703	2009
15	225	1045.02	0.0010000	17.168	0.077166	0.3256	3025			1.720	1862
15	230	1074.91	0.0000000	17.418	0.078621	0.3323	3075			1.737	1715
15	235	1104.80	0.0000000	17.668	0.080076	0.3390	3125			1.754	1568
15	240	1134.69	0.0000000	17.918	0.081531	0.3457	3175			1.771	1421
15	245	1164.58	0.0000000	18.168	0.082986	0.3524	3225			1.788	1274
15	250	1194.47	0.0000000	18.418	0.084441	0.3591	3275			1.805	1127
15	255	1224.36	0.0000000	18.668	0.085896	0.3658	3325			1.822	980
15	260	1254.25	0.0000000	18.918	0.087351	0.3725	3375			1.839	833
15	265	1284.14	0.0000000	19.168	0.088806	0.3792	3425			1.856	686
15	270	1314.03	0.0000000	19.418	0.090261	0.3859	3475			1.873	539
15	275	1343.92	0.0000000	19.668	0.091716	0.3926	3525			1.890	392
15	280	1373.81	0.0000000	19.918	0.093171	0.3993	3575			1.907	245
15	285	1403.70	0.0000000	20.168	0.094626	0.4060	3625			1.924	98
15	290	1433.59	0.0000000	20.418	0.096081	0.4127	3675			1.941	
15	295	1463.48	0.0000000	20.668	0.097536	0.4194	3725			1.958	
15	300	1493.37	0.0000000	20.918	0.098991	0.4261	3775			1.975	
15	305	1523.26	0.0000000	21.168	0.099946	0.4328	3825			1.992	
15	310	1553.15	0.0000000	21.418	0.100901	0.4395	3875			2.009	
15	315	1583.04	0.0000000	21.668	0.101856	0.4462	3925			2.026	
15	320	1612.93	0.0000000	21.918	0.102811	0.4529	3975			2.043	
15	325	1642.82	0.0000000	22.168	0.103766	0.4596	4025			2.060	
15	330	1672.71	0.0000000	22.418	0.104721	0.4663	4075			2.077	
15	335	1702.60	0.0000000	22.668	0.105676	0.4730	4125			2.094	
15	340	1732.49	0.0000000	22.918	0.106631	0.4797	4175			2.111	
15	345	1762.38	0.0000000	23.168	0.107586	0.4864	4225			2.128	
15	350	1792.27	0.0000000	23.418	0.108541	0.4931	4275			2.145	
15	355	1822.16	0.0000000	23.668	0.109496	0.4998	4325			2.162	
15	360	1852.05	0.0000000	23.918	0.110451	0.5065	4375			2.179	
15	365	1881.94	0.0000000	24.168	0.111406	0.5132	4425			2.196	
15	370	1911.83	0.0000000	24.418	0.112361	0.5199	4475			2.213	
15	375	1941.72	0.0000000	24.668	0.113316	0.5266	4525			2.230	
15	380	1971.61	0.0000000	24.918	0.114271	0.5333	4575			2.247	
15	385	2001.50	0.0000000	25.168	0.115226	0.5400	4625			2.264	
15	390	2031.39	0.0000000	25.418	0.116181	0.5467	4675			2.281	
15	395	2061.28	0.0000000	25.668	0.117136	0.5534	4725			2.298	
15	400	2091.17	0.0000000	25.918	0.118091	0.5601	4775			2.315	
15	405	2121.06	0.0000000	26.168	0.119046	0.5668	4825			2.332	
15	410	2150.95	0.0000000	26.418	0.120001	0.5735	4875			2.349	
15	415	2180.84	0.0000000	26.668	0.120956	0.5802	4925			2.366	
15	420	2210.73	0.0000000	26.918	0.121911	0.5869	4975			2.383	
15	425	2240.62	0.0000000	27.168	0.122866	0.5936	5025			2.400	
15	430	2270.51	0.0000000	27.418	0.123821	0.6003	5075			2.417	
15	435	2300.40	0.0000000	27.668	0.124776	0.6070	5125			2.434	
15	440	2330.29	0.0000000	27.918	0.125731	0.6137	5175			2.451	
15	445	2360.18	0.0000000	28.168	0.126686	0.6204	5225			2.468	
15	450	2390.07	0.0000000	28.418	0.127641	0.6271	5275			2.485	
15	455	2419.96	0.0000000	28.668	0.128596	0.6338	5325			2.502	
15	460	2449.85	0.0000000	28.918	0.129551	0.6405	5375			2.519	
15	465	2479.74	0.0000000	29.168	0.130506	0.6472	5425			2.536	
15	470	2509.63	0.0000000	29.418	0.131461	0.6539	5475			2.553	
15	475	2539.52	0.0000000	29.668	0.132416	0.6606	5525			2.570	
15	480	2569.41	0.0000000	29.918	0.133371	0.6673	5575			2.587	
15	485	2599.30	0.0000000	30.168	0.134326	0.6740	5625			2.604	
15	490	2629.19	0.0000000	30.418	0.135281	0.6807	5675			2.621	
15	495	2659.08	0.0000000	30.668	0.136236	0.6874	5725			2.638	
15	500	2688.97	0.0000000	30.918	0.137191	0.6941	5775			2.655	
15	505	2718.86	0.0000000	31.168	0.138146	0.7008	5825			2.672	
15	510	2748.75	0.0000000	31.418	0.139101	0.7075	5875			2.689	
15	515	2778.64	0.0000000	31.668	0.140056	0.7142	5925			2.706	
15	520	2808.53	0.0000000	31.918	0.141011	0.7209	5975			2.723	
15	525	2838.42	0.0000000	32.168	0.141966	0.7276	6025			2.740	
15	530	2868.31	0.0000000	32.418	0.142921	0.7343	6075			2.757	
15	535	2898.20	0.0000000	32.668	0.143876	0.7410</					

## EQUILIBRIUM HYDROGEN (OUTPUT FROM ET PROGRAMS)

PSIA	TEMPERATURE DEG. R	ENTHALPY BTU/LB	DENSITY LB/CU.FT	ENTROPY BTU/LB-R	CONDUCTIVITY BTU/LB-R IN/FT-R	VISCOSITY LB-M/IN <sup>2</sup> FT *10 <sup>-4</sup>	VEL. SOUND FT/S	C-P BTU/LE-K	C-V BTU/LB-R	CP/CV RATIO	L FACTOR
50	25	-156.01	4.8285905	1.183	0.043395	1.4689	4210	1.545	1.134	1.330	1524
50	30	-122.16	4.6593210	1.500	0.053374	1.1025	3919	1.271	1.271	1.454	2130
50	35	-111.68	4.4900515	1.817	0.056959	0.8478	3646	2.245	1.446	1.553	2666
50	40	-98.03	4.2833894	2.169	0.059423	0.6706	3325	2.778	1.663	1.674	3271
50	45	-82.48	4.0673792	2.531	0.059163	0.5478	2895	3.867	1.844	1.642	3928
50	50	-68.69	0.2243215	6.713	0.017136	0.0920	1212	3.972	2.243	1.771	3937
50	55	108.64	0.194434	7.091	0.019664	0.0994	1281	4.046	2.527	1.601	4162
50	60	149.10	0.1728893	7.435	0.022316	0.1064	1340	4.186	2.793	1.499	4417
50	65	170.16	0.1567762	7.754	0.025157	0.1135	1396	4.325	3.048	1.419	4642
50	70	191.08	0.1437162	8.071	0.027940	0.1205	1450	4.467	3.227	1.364	4940
50	75	214.35	0.1326472	8.399	0.031160	0.1272	1503	4.564	3.375	1.352	5132
50	80	237.23	0.1230287	8.685	0.033303	0.1338	1555	4.631	3.475	1.333	5358
50	85	260.56	0.1150166	8.961	0.035083	0.1404	1607	4.637	3.510	1.321	5458
50	90	283.42	0.1077292	9.260	0.037083	0.1474	1660	4.635	3.529	1.313	5513
50	95	306.07	0.1014798	9.501	0.038587	0.1531	1712	4.579	3.497	1.313	5529
50	100	328.72	0.0959951	9.743	0.041095	0.1595	1764	4.516	3.438	1.314	5516
50	110	373.30	0.0872226	10.194	0.041668	0.1714	1867	4.338	3.279	1.323	5401
50	120	415.54	0.0795757	10.517	0.043242	0.1830	1976	4.146	3.113	1.337	5287
50	130	456.35	0.0732437	10.841	0.044996	0.1942	2071	3.971	2.933	1.354	5132
50	140	495.13	0.0677065	11.164	0.046751	0.2050	2166	3.810	2.741	1.371	4977
50	150	532.37	0.0629936	11.435	0.048566	0.2156	2262	3.653	2.536	1.388	4873
50	160	568.57	0.0590316	11.670	0.049580	0.2259	2347	3.496	2.343	1.401	4769
50	170	601.61	0.0554533	11.906	0.049747	0.2359	2433	3.339	2.151	1.415	4696
50	180	627.60	0.0523500	12.140	0.048891	0.2469	2519	3.183	1.959	1.429	4620
50	190	660.53	0.0495917	12.287	0.049829	0.2562	2595	3.033	1.766	1.445	4623
50	200	693.45	0.0468333	12.435	0.051267	0.2662	2671	2.876	1.574	1.460	4630
50	250	858.09	0.0367500	13.172	0.059459	0.3225	3002	3.164	1.267	1.450	4754
50	300	1021.43	0.0303875	13.748	0.067010	0.3442	3278	3.199	1.050	1.438	4993
50	350	1182.83	0.0260938	14.262	0.075894	0.3640	3527	3.251	0.826	1.427	5180
50	400	1345.57	0.0228646	14.696	0.084747	0.4210	3759	3.304	0.610	1.417	5341
50	450	1513.62	0.0203438	15.089	0.093244	0.4565	3969	3.352	0.413	1.409	5519
50	500	1681.05	0.0187350	15.455	0.101495	0.4910	4174	3.399	0.235	1.397	5655
50	550	1854.48	0.0171800	15.725	0.107941	0.5213	4372	3.439	0.075	1.386	5827
50	600	2027.11	0.0156250	15.995	0.114388	0.5497	4560	3.456	0.000	1.399	5927
50	700	2372.30	0.0133950	16.535	0.127280	0.6670	5258	3.461	2.476	1.398	602
50	800	2717.64	0.0117250	17.075	0.140173	0.7257	5817	3.468	2.483	1.397	602
50	900	3062.91	0.0104250	17.483	0.153066	0.7844	6315	3.475	2.490	1.396	618
50	1000	3408.17	0.0093850	17.812	0.165958	0.8079	6815	3.492	2.507	1.393	6370
50	1100	3760.19	0.0084164	18.060	0.179363	0.9079	7151	3.523	2.538	1.388	6542
50	1200	4200.19	0.0075250	18.248	0.193683	1.0179	7691	3.574	2.569	1.381	6785
50	1300	4644.21	0.0066200	19.248	0.214404	1.1427	8232	3.624	2.639	1.373	7029
50	1400	5095.59	0.0057361	21.048	0.236888	1.2539	8679	3.694	2.739	1.364	7313
50	1500	5552.21	0.0048267	21.429	0.260894	1.3571	9127	3.764	2.779	1.354	7597
50	1600	6004.21	0.0039303	19.802	0.284954	1.4571	9536	3.843	2.857	1.345	7976
50	1700	6456.21	0.0030361	21.810	0.308894	1.5539	9921	3.921	2.941	1.335	8107
50	1800	6908.21	0.0021408	22.112	0.33257	1.6462	10292	4.036	3.047	1.325	8432
50	1900	7360.21	0.0012500	22.415	0.357200	1.7462	10609	4.181	3.146	1.312	8756
50	2000	7812.21	0.0003633	22.718	0.382000	1.8462	10926	4.377	3.271	1.293	9570
50	2100	8264.21	0.0000000	23.020	0.406900	1.9462	11183	4.738	3.702	1.280	10383
50	2200	8716.21	0.0000000	23.360	0.431800	2.0462	11426	5.213	4.134	1.261	12299
50	2300	9168.21	0.0000000	23.700	0.456700	2.1462	11669	5.685	4.528	1.241	14215
50	2400	9620.21	0.0000000	24.040	0.481600	2.2462	11912	6.156	4.923	1.222	16108
50	2500	10072.21	0.0000000	24.380	0.506500	2.3462	12154	6.628	5.318	1.209	22001
50	2600	10524.21	0.0000000	24.720	0.531400	2.4462	12396	7.100	5.713	1.193	26657
50	2700	10976.21	0.0000000	25.060	0.556300	2.5462	12638	7.572	6.108	1.177	31313
50	2800	11428.21	0.0000000	25.400	0.581200	2.6462	12880	8.044	6.503	1.161	35967
50	2900	11880.21	0.0000000	25.740	0.606100	2.7462	13122	8.516	6.898	1.145	40621
50	3000	12332.21	0.0000000	26.080	0.631000	2.8462	13364	8.988	7.293	1.129	45275
50	3100	12784.21	0.0000000	26.420	0.655900	2.9462	13606	9.460	7.688	1.113	49929
50	3200	13236.21	0.0000000	26.760	0.680800	3.0462	13848	9.932	8.083	1.097	54583
50	3300	13688.21	0.0000000	27.100	0.705700	3.1462	14090	10.404	8.478	1.081	59237
50	3400	14140.21	0.0000000	27.440	0.730600	3.2462	14332	10.876	8.873	1.065	63891
50	3500	14592.21	0.0000000	27.780	0.755500	3.3462	14574	11.348	9.268	1.049	68545
50	3600	15044.21	0.0000000	28.120	0.780400	3.4462	14816	11.820	9.663	1.033	73199
50	3700	15496.21	0.0000000	28.460	0.805300	3.5462	15058	12.292	10.058	1.017	77853
50	3800	15948.21	0.0000000	28.800	0.830200	3.6462	15300	12.764	10.453	1.001	82507
50	3900	16400.21	0.0000000	29.140	0.855100	3.7462	15542	13.236	10.848	0.985	87161
50	4000	16852.21	0.0000000	29.480	0.880000	3.8462	15784	13.708	11.243	0.969	91815
50	4100	17304.21	0.0000000	29.820	0.904900	3.9462	16026	14.180	11.638	0.953	96469
50	4200	17756.21	0.0000000	30.160	0.929800	4.0462	16268	14.652	12.033	0.937	101123
50	4300	18208.21	0.0000000	30.500	0.954700	4.1462	16510	15.124	12.428	0.921	105777
50	4400	18660.21	0.0000000	30.840	0.979600	4.2462	16752	15.596	12.823	0.905	110431
50	4500	19112.21	0.0000000	31.180	1.004500	4.3462	16994	16.068	13.218	0.889	115085
50	4600	19564.21	0.0000000	31.520	1.029400	4.4462	17236	16.540	13.613	0.873	119739
50	4700	20016.21	0.0000000	31.860	1.054300	4.5462	17478	17.012	14.008	0.857	124393
50	4800	20468.21	0.0000000	32.200	1.079200	4.6462	17720	17.484	14.403	0.841	129047
50	4900	20920.21	0.0000000	32.540	1.104100	4.7462	17962	17.956	14.798	0.825	133701
50	5000	21372.21	0.0000000	32.880	1.129000	4.8462	18204	18.428	15.193	0.809	138355
50	5100	21824.21	0.0000000	33.220	1.153900	4.9462	18446	18.900	15.588	0.793	143009
50	5200	22276.21	0.0000000	33.560	1.178800	5.0462	18688	19.372	15.983	0.777	147663
50	5300	22728.21	0.0000000	33.900	1.203700	5.1462	18930	19.844	16.378	0.761	152317
50	5400	23180.21	0.0000000	34.240	1.228600	5.2462	19172	20.316	16.773	0.745	156971
50	5500	23632.21	0.0000000	34.580	1.253500	5.3462	19414	20.788	17.168	0.729	161625
50	5600	24084.21	0.0000000	34.920	1.278400	5.4462	19656	21.260	17.563	0.713	166279
50	5700	24536.21	0.0000000	35.260	1.303300	5.5462	19898	21.732	17.958	0.697	170933
50	5800	24988.21	0.0000000	35.600	1.328200	5.6462	20140	22.204	18.353	0.681	175587
50	5900	25440.21	0.0000000	35.940	1.353100	5.7462	20382	22.676	18.748	0.665	180241
50	6000	25892.21	0.0000000	36.280	1.378000	5.8462	20624	23.148	19.143	0.649	184895

## EQUILIBRIUM HYDROGEN (OUTPUT FROM ET PROGRAMS)

PSIA	TEMPERATURE DEG. R	ENTHALPY BTU/LB	DENSITY LB/CU-FT	ENTROPY BTU/LB-R	CONDUCTIVITY BTU/H -FT-R	VISCOSITY LB-H/50-FT *10**10	VEL.SOUND FT/S	C-P BTU/LB-K	C-V BTU/LB-R	CP/CV RATIO	L FACTOR
150	25	-152.40	4.8529367	1.182	0.044596	1.5168	4259	1.567	1.147	1.366	1539
150	30	-119.80	4.7819630	1.472	0.054013	1.1558	4026	1.828	1.268	1.441	2093
150	35	-108.78	4.5488212	1.782	0.058005	0.8095	3765	2.209	1.441	1.533	2618
150	40	-96.36	4.3510571	2.122	0.060917	0.7149	3466	2.717	1.655	1.641	3199
150	45	-89.91	4.1541375	2.468	0.061324	0.5825	3082	3.396	1.809	1.798	3817
150	50	-80.84	3.7784168	2.924	0.059485	0.4735	2600	4.477	2.167	2.066	4529
150	55	-33.98	3.3386485	3.426	0.055268	0.2863	1668	7.359	2.540	2.878	5912
150	60	187.90	8.7136857	5.869	0.028110	0.1284	1120	6.977	3.044	2.292	5945
150	65	138.33	8.5762483	6.382	0.029159	0.1300	1246	5.658	3.142	1.801	5497
150	70	165.57	8.4986615	6.803	0.031144	0.1316	1316	5.327	3.293	1.618	5493
150	75	192.21	8.4433508	7.167	0.033281	0.1358	1411	5.175	3.419	1.514	5567
150	80	217.81	8.4019304	7.496	0.035240	0.1416	1483	5.038	3.509	1.453	5662
150	85	243.19	8.3692396	7.805	0.037309	0.1474	1547	5.026	3.539	1.420	5709
150	90	267.26	8.3430227	8.097	0.038929	0.1532	1612	4.948	3.555	1.392	5727
150	95	291.26	8.3196242	8.338	0.040301	0.1590	1673	4.848	3.510	1.381	5716
150	100	315.26	8.2998829	8.579	0.042246	0.1649	1733	4.744	3.459	1.372	5690
150	110	362.39	8.2680677	9.048	0.043505	0.1762	1848	4.511	3.295	1.369	5547
150	120	406.08	8.2427220	9.413	0.044765	0.1875	1977	4.284	3.112	1.377	5403
150	130	448.21	8.2220253	9.755	0.045349	0.1985	2076	4.086	2.942	1.389	5230
150	140	488.82	8.2047782	10.048	0.045934	0.2089	2175	3.907	2.789	1.401	5057
150	150	526.11	8.1901492	10.312	0.046777	0.2192	2274	3.727	2.635	1.415	4946
150	160	563.05	8.1775102	10.556	0.047620	0.2292	2362	3.521	2.540	1.426	4835
150	170	597.34	8.1665356	10.796	0.048463	0.2387	2450	3.314	2.445	1.437	4756
150	180	628.72	8.1570500	11.025	0.049372	0.2480	2538	3.107	2.351	1.450	4668
150	190	657.87	8.1487750	11.174	0.050787	0.2512	2615	3.358	2.207	1.456	4667
150	200	691.02	8.1405000	11.323	0.052202	0.2604	2692	3.308	2.263	1.462	4666
150	250	856.78	8.1102500	12.066	0.059276	0.3061	3027	3.194	2.173	1.470	4661
150	300	1021.06	8.0911625	12.645	0.067681	0.3471	3302	3.217	2.212	1.454	4817
150	350	1183.12	8.0782813	13.162	0.076417	0.3862	3550	3.265	2.266	1.441	5010
150	400	1348.47	8.0689938	13.680	0.085151	0.4227	3781	3.313	2.320	1.428	5192
150	450	1516.94	8.0610312	13.994	0.093544	0.4577	3990	3.359	2.368	1.419	5353
150	500	1683.55	8.0559525	14.368	0.101685	0.4918	4194	3.405	2.416	1.409	5524
150	550	1856.25	8.0513225	14.630	0.108884	0.5209	4390	3.423	2.435	1.406	5591
150	600	2028.94	8.0466925	14.900	0.114483	0.5500	4578	3.442	2.455	1.402	5658
150	700	2376.33	8.0400550	15.440	0.127281	0.6082	4936	3.461	2.472	1.399	5793
150	800	2719.73	8.0350750	15.980	0.140079	0.6664	5274	3.461	2.476	1.398	5927
150	900	3065.12	8.0311975	16.348	0.152677	0.7246	5552	3.468	2.483	1.397	6061
150	1000	3418.51	8.0288925	16.717	0.165675	0.7827	5831	3.475	2.490	1.396	6196
150	1250	4282.57	8.0224663	17.508	0.193250	0.9855	6528	3.493	2.508	1.393	6367
150	1500	5154.63	8.0186856	18.157	0.220825	1.0294	7162	3.523	2.538	1.388	6538
150	1750	6046.63	8.0168717	18.707	0.249263	1.1390	7701	3.574	2.589	1.381	6788
150	2000	6938.63	8.0148794	19.190	0.277700	1.2497	8241	3.624	2.639	1.373	7038
150	2250	7862.59	8.0125101	19.572	0.306883	1.3524	8688	3.694	2.709	1.364	7322
150	2500	8786.54	8.0111944	19.955	0.336865	1.4551	9135	3.764	2.779	1.354	7607
150	2750	9754.77	8.0102686	20.337	0.372970	1.5514	9547	3.840	2.855	1.345	7982
150	3000	10728.88	8.0093429	20.720	0.395300	1.6477	9934	3.920	2.935	1.336	8102
150	3250	11718.83	8.0086793	21.016	0.429917	1.7395	10312	4.012	3.024	1.326	8395
150	3500	12781.67	8.0080196	21.313	0.465533	1.8314	10650	4.122	3.131	1.317	8688
150	3750	13765.88	8.0075168	21.609	0.510088	1.9198	10988	4.260	3.261	1.306	9245
150	4000	14828.33	8.0078163	21.905	0.574403	2.0061	11274	4.468	3.473	1.292	9802
150	4250	16024.17	8.0086229	22.201	0.681867	2.0957	11546	4.742	3.743	1.278	11028
150	4500	17228.80	8.0082294	22.498	0.7901250	2.1833	11804	5.245	4.162	1.260	12254
150	4750	18780.83	8.0059866	22.794	1.006792	2.2735	12039	5.906	4.750	1.243	14692
150	5000	20181.67	8.0055838	23.090	1.223333	2.3637	12274	6.698	5.451	1.229	17131
150	5250	22188.83	8.0053068	23.524	1.611583	2.4615	12552	7.934	6.682	1.187	21318
150	5500	24188.00	8.0050298	23.958	1.999833	2.5593	12809	9.384	7.941	1.182	25506
150	5750	27021.67	8.0047813	24.391	2.603417	2.6659	13088	11.156	9.267	1.204	31709
150	6000	29863.33	8.0045328	24.825	3.207888	2.7725	13381	12.905	10.967	1.177	37913

## EQUILIBRIUM HYDROGEN (OUTPUT FROM ET PROGRAMS)

PSIA	TEMPERATURE DEG. R	ENTHALPY BTU/LB	DENSITY LB/CU.FT	ENTROPY BTU/LB-R	CONDUCTIVITY BTU/H -FT-R	VISCOSITY LB-M/ SQ.FT *10**10	VEL. SOUND FT/S	C-P BTU/LB-K	C-V BTU/LB-R	CP/CV RATIO	L FACTOR
500	25	-139.74	4.9339590	1.181	0.048695	1.6706	4440	1.565	1.163	1.322	1573
500	30	-187.91	4.8368185	1.391	0.055986	1.3443	4324	1.743	1.264	1.379	1979
500	35	-98.28	4.6990388	1.685	0.061232	1.0344	4113	2.073	1.427	1.453	2481
500	40	-86.79	4.5401384	1.996	0.065316	0.8378	3866	2.497	1.644	1.519	3020
500	45	-73.00	4.3757578	2.311	0.067162	0.6954	3576	3.001	1.867	1.590	3559
500	50	-56.38	4.1496206	2.673	0.067406	0.5899	3248	3.610	2.163	1.669	4105
500	55	-36.34	3.9070313	3.047	0.066351	0.5016	2866	4.386	2.502	1.753	4670
500	60	-12.67	3.6066790	3.461	0.063943	0.4271	2502	5.322	2.827	1.882	5248
500	65	16.56	3.2640811	3.945	0.060740	0.3629	2114	6.478	3.101	2.009	5888
500	70	52.35	2.8046777	4.467	0.057937	0.3024	1771	7.844	3.330	2.356	6641
500	75	94.84	2.3188633	5.036	0.054637	0.2561	1553	9.276	3.505	2.647	7118
500	80	135.92	1.8955697	5.599	0.051483	0.2269	1497	8.002	3.598	2.224	7069
500	85	174.19	1.6003867	6.031	0.049964	0.2107	1540	7.309	3.618	2.020	6796
500	90	210.13	1.4068329	6.447	0.049356	0.2034	1582	6.592	3.624	1.819	6607
500	95	239.29	1.2519303	6.745	0.049203	0.1997	1650	6.169	3.574	1.726	6452
500	100	268.45	1.1366356	7.043	0.049272	0.1996	1717	5.774	3.510	1.641	6299
500	110	324.96	0.9751344	7.804	0.049934	0.2026	1853	5.227	3.344	1.563	6055
500	120	374.24	0.8576120	8.027	0.050096	0.2089	1981	4.811	3.152	1.526	5811
500	130	421.17	0.7690773	8.418	0.050084	0.2169	2094	4.498	2.974	1.512	5575
500	140	464.59	0.6993679	8.732	0.050072	0.2251	2207	4.245	2.815	1.504	5339
500	150	505.65	0.6427857	9.016	0.050666	0.2335	2320	3.993	2.656	1.504	5202
500	160	545.13	0.5955868	9.275	0.051260	0.2422	2415	3.852	2.554	1.508	5064
500	170	583.16	0.5555336	9.527	0.051924	0.2509	2509	3.711	2.453	1.513	4968
500	180	614.62	0.5235000	9.726	0.052808	0.2576	2604	3.570	2.352	1.518	4837
500	190	648.57	0.4959167	9.878	0.054141	0.2663	2686	3.509	2.311	1.518	4807
500	200	682.51	0.4683333	10.031	0.055473	0.2751	2767	3.448	2.271	1.519	4818
500	250	852.22	0.3675000	18.793	0.062136	0.3188	3115	3.291	2.192	1.501	4722
500	300	1019.79	0.3038750	11.448	0.070027	0.3574	3385	3.281	2.232	1.470	4698
500	350	1184.15	0.2609375	11.944	0.078249	0.3941	3629	3.313	2.282	1.452	5068
500	400	1349.62	0.2286458	12.416	0.086564	0.4286	3856	3.345	2.333	1.434	5235
500	450	1519.54	0.2034375	12.798	0.094596	0.4620	4061	3.383	2.378	1.423	5384
500	500	1689.50	0.1825780	13.180	0.102350	0.4946	4262	3.422	2.424	1.412	5539
500	550	1862.42	0.1676625	13.451	0.110583	0.5228	4456	3.457	2.463	1.403	5684
500	600	2035.34	0.1527551	13.722	0.114817	0.5511	4640	3.452	2.461	1.403	5869
500	700	2381.18	0.1313500	14.263	0.127282	0.6076	4995	3.464	2.476	1.399	5798
500	800	2727.02	0.1152500	14.805	0.139750	0.6640	5328	3.464	2.478	1.398	5928
500	900	3072.86	0.1026550	15.173	0.152217	0.7205	5604	3.471	2.485	1.397	6057
500	1000	3418.70	0.0925550	15.542	0.164683	0.7770	5881	3.477	2.491	1.396	6187
500	1250	4298.90	0.0742925	16.333	0.191733	0.8973	6572	3.494	2.508	1.393	6357
500	1500	5163.10	0.0618445	16.983	0.218783	1.0175	7201	3.523	2.538	1.388	6527
500	1750	6055.10	0.0532503	17.537	0.246242	1.1260	7737	3.574	2.589	1.381	6797
500	2000	6947.10	0.0466770	18.020	0.277700	1.2350	8274	3.624	2.639	1.373	7068
500	2250	7870.95	0.0415014	18.401	0.306842	1.3358	8719	3.694	2.709	1.364	7356
500	2500	8794.80	0.0372984	18.783	0.335983	1.4367	9165	3.764	2.779	1.355	7643
500	2750	9762.40	0.0342154	19.164	0.371967	1.5313	9575	3.838	2.853	1.345	8004
500	3000	10738.00	0.0311323	19.545	0.394633	1.6260	9962	3.916	2.931	1.336	8415
500	3250	11715.00	0.0289219	19.838	0.426417	1.7163	10340	3.996	3.010	1.328	8801
500	3500	12700.00	0.0267116	20.130	0.458200	1.8067	10683	4.084	3.096	1.319	8668
500	3750	13748.00	0.0250485	20.422	0.499900	1.8935	11026	4.182	3.191	1.311	9014
500	4000	14788.00	0.0231055	20.715	0.541600	1.9803	11323	4.326	3.325	1.301	9359
500	4250	15803.33	0.0220793	20.984	0.610517	2.0658	11609	4.502	3.489	1.290	10078
500	4500	17026.67	0.0207732	21.252	0.679433	2.1513	11879	4.766	3.729	1.278	10798
500	4750	18301.67	0.0197083	21.521	0.803850	2.2385	12125	5.134	4.059	1.265	12140
500	5000	19576.67	0.0186434	21.790	0.928267	2.3257	12371	5.571	4.450	1.252	13483
500	5250	21128.33	0.0177393	22.121	1.163967	2.4183	12646	6.245	5.041	1.239	15758
500	5500	22680.00	0.0168352	22.453	1.359667	2.5118	12897	7.036	5.726	1.229	18033
500	5750	24666.67	0.0160322	22.784	1.703167	2.6108	13161	8.061	6.551	1.221	21463
500	6000	26853.33	0.0152293	23.115	2.040667	2.7107	13433	9.162	7.525	1.218	24894



EQUILIBRIUM HYDROGEN (OUTPUT FROM ET PROGRAMS)

PSIA	TEMPERATURE DEG. R	ENTHALPY BTU/LB	DENSITY LB/CU.FT	ENTROPY BTU/LB-R	CONDUCTIVITY BTU/H - FT-R	VISCOSITY LB-M/ SQ.FT *10**10	VEL.SOUND FT/S	C-P BTU/LB-R	C-V BTU/LB-R	CP/CV RATIO	L FACTOR
1500	25	-104.56	5.1646222	1.210	0.063373	1.9612	4903	1.632	1.205	1.270	1685
1500	30	-104.56	5.1543206	1.231	0.061091	1.9179	4903	1.632	1.205	1.270	1727
1500	35	-67.30	5.0271414	1.489	0.068413	1.4580	4773	1.893	1.434	1.320	2220
1500	40	-57.03	4.8999621	1.774	0.074561	1.1743	4632	2.230	1.640	1.360	2721
1500	45	-44.94	4.7727828	2.066	0.078296	0.9808	4418	2.635	1.903	1.385	3213
1500	50	-30.74	4.6456035	2.357	0.081533	0.8471	4203	3.040	2.160	1.403	3695
1500	55	-14.26	4.5122087	2.658	0.084759	0.7432	3909	3.522	2.489	1.415	4159
1500	60	4.57	4.3539517	2.994	0.088193	0.6559	3774	4.011	2.818	1.423	4587
1500	65	25.66	4.1956948	3.330	0.091428	0.5937	3589	4.446	3.092	1.438	4952
1500	70	48.79	4.0374378	3.666	0.094912	0.5416	3404	4.801	3.262	1.463	5317
1500	75	73.70	3.8667813	4.001	0.079806	0.4965	3219	5.155	3.473	1.484	5586
1500	80	100.06	3.6878586	4.336	0.078700	0.4558	3034	5.365	3.547	1.512	5856
1500	85	127.57	3.5089358	4.670	0.077282	0.4244	2937	5.555	3.630	1.541	6030
1500	90	155.77	3.3300131	5.005	0.075864	0.3953	2840	5.684	3.630	1.566	6204
1500	95	184.35	3.1622829	5.294	0.074332	0.3752	2743	5.774	3.595	1.588	6372
1500	100	212.93	2.9945528	5.584	0.072540	0.3560	2646	5.774	3.555	1.610	6540
1500	110	269.38	2.6738037	6.139	0.070076	0.3282	2613	5.534	3.339	1.633	6728
1500	120	322.98	2.4123798	6.599	0.067512	0.3114	2591	5.268	3.234	1.644	6884
1500	130	374.49	2.1796885	7.018	0.065648	0.3033	2646	4.983	3.028	1.646	6976
1500	140	422.85	1.9901883	7.378	0.063704	0.2952	2701	4.712	2.870	1.642	7068
1500	150	468.51	1.8314030	7.694	0.061336	0.2912	2757	4.442	2.712	1.638	7160
1500	160	512.37	1.6930890	7.981	0.058288	0.2979	2806	4.252	2.599	1.636	7252
1500	170	553.57	1.5818402	8.295	0.0562790	0.3011	2856	4.063	2.487	1.634	7344
1500	180	598.06	1.4854167	8.442	0.0562670	0.3038	2906	3.874	2.374	1.632	7436
1500	190	624.06	1.4055000	8.607	0.0563746	0.3112	3034	3.796	2.317	1.624	7528
1500	200	660.12	1.3255833	8.772	0.0564823	0.3186	3102	3.710	2.299	1.617	7620
1500	250	840.43	1.0417167	9.596	0.070205	0.3560	3408	3.497	2.241	1.560	8049
1500	300	1016.89	0.8644583	10.296	0.076608	0.3969	3650	3.419	2.281	1.499	8478
1500	350	1187.56	0.7442556	10.809	0.083361	0.4433	3822	3.420	2.323	1.472	8907
1500	400	1358.68	0.6564139	11.298	0.090495	0.4852	4031	3.421	2.360	1.440	9336
1500	450	1532.80	0.58636250	11.686	0.097515	0.4739	4274	3.465	2.405	1.431	9765
1500	500	1706.56	0.5258500	12.075	0.104250	0.5282	4463	3.465	2.445	1.417	10194
1500	550	1880.66	0.4640750	12.348	0.110010	0.5841	4647	3.471	2.460	1.411	10623
1500	600	2053.62	0.4423000	12.620	0.115770	0.6460	4823	3.479	2.475	1.405	11052
1500	650	2200.74	0.3819500	13.165	0.122790	0.6660	5004	3.479	2.485	1.400	11481
1500	700	2347.86	0.3363000	13.710	0.130810	0.6578	5186	3.473	2.493	1.399	11910
1500	750	2494.98	0.3004500	14.080	0.150330	0.7097	5366	3.478	2.499	1.397	12339
1500	800	2642.10	0.2715000	14.450	0.161850	0.7615	5546	3.483	2.495	1.396	12768
1500	850	2789.22	0.2425000	15.240	0.197500	0.8748	5726	3.486	2.509	1.393	13197
1500	900	2936.34	0.2135000	15.808	0.212950	0.9880	5906	3.524	2.538	1.388	13626
1500	950	3083.46	0.1845000	16.442	0.245325	1.0908	6086	3.574	2.588	1.381	14055
1500	1000	3230.58	0.1555000	17.075	0.277700	1.1930	6266	3.623	2.638	1.373	14484
1500	1050	3377.70	0.1265000	17.708	0.306725	1.2885	6446	3.673	2.688	1.364	14913
1500	1100	3524.82	0.1111950	17.608	0.335750	1.3840	6626	3.723	2.738	1.355	15342
1500	1150	3671.94	0.1000000	18.442	0.369100	1.4740	6806	3.763	2.778	1.355	15771
1500	1200	3819.06	0.0900000	19.275	0.399300	1.5640	6986	3.813	2.821	1.345	16200
1500	1250	3966.18	0.0800000	20.108	0.428500	1.6540	7166	3.863	2.867	1.336	16629
1500	1300	4113.30	0.0700000	20.941	0.457700	1.7440	7346	3.913	2.912	1.326	17058
1500	1350	4260.42	0.0600000	21.774	0.486900	1.8340	7526	3.963	2.958	1.317	17487
1500	1400	4407.54	0.0500000	22.607	0.516100	1.9240	7706	4.013	3.004	1.320	17916
1500	1450	4554.66	0.0400000	23.440	0.545300	2.0140	7886	4.063	3.050	1.312	18345
1500	1500	4701.78	0.0300000	24.273	0.574500	2.1040	8066	4.113	3.096	1.305	18774
1500	1550	4848.90	0.0200000	25.106	0.603700	2.1940	8246	4.163	3.142	1.297	19203
1500	1600	4996.02	0.0100000	25.939	0.632900	2.2840	8426	4.213	3.188	1.290	19632
1500	1650	5143.14	0.0050000	26.772	0.662100	2.3740	8606	4.263	3.234	1.283	20061
1500	1700	5290.26	0.0025000	27.605	0.691300	2.4640	8786	4.313	3.280	1.276	20490
1500	1750	5437.38	0.0012500	28.438	0.720500	2.5540	8966	4.363	3.326	1.269	20919
1500	1800	5584.50	0.0006250	29.271	0.749700	2.6440	9146	4.413	3.372	1.262	21348
1500	1850	5731.62	0.0003125	30.104	0.778900	2.7340	9326	4.463	3.418	1.255	21777
1500	1900	5878.74	0.0001562	30.937	0.808100	2.8240	9506	4.513	3.464	1.248	22206
1500	1950	6025.86	0.0000781	31.770	0.837300	2.9140	9686	4.563	3.510	1.241	22635
1500	2000	6172.98	0.0000391	32.603	0.866500	3.0040	9866	4.613	3.556	1.234	23064
1500	2050	6320.10	0.0000195	33.436	0.895700	3.0940	10046	4.663	3.602	1.227	23493
1500	2100	6467.22	0.0000098	34.269	0.924900	3.1840	10226	4.713	3.648	1.220	23922
1500	2150	6614.34	0.0000049	35.102	0.954100	3.2740	10406	4.763	3.694	1.213	24351
1500	2200	6761.46	0.0000025	35.935	0.983300	3.3640	10586	4.813	3.740	1.206	24780
1500	2250	6908.58	0.0000012	36.768	1.012500	3.4540	10766	4.863	3.786	1.199	25209
1500	2300	7055.70	0.0000006	37.601	1.041700	3.5440	10946	4.913	3.832	1.192	25638
1500	2350	7202.82	0.0000003	38.434	1.070900	3.6340	11126	4.963	3.878	1.185	26067
1500	2400	7349.94	0.0000001	39.267	1.100100	3.7240	11306	5.013	3.924	1.178	26496
1500	2450	7497.06	0.0000000	40.100	1.129300	3.8140	11486	5.063	3.970	1.171	26925
1500	2500	7644.18	0.0000000	40.933	1.158500	3.9040	11666	5.113	4.016	1.164	27354
1500	2550	7791.30	0.0000000	41.766	1.187700	4.0040	11846	5.163	4.062	1.157	27783
1500	2600	7938.42	0.0000000	42.600	1.216900	4.1040	12026	5.213	4.108	1.150	28212
1500	2650	8085.54	0.0000000	43.433	1.246100	4.2040	12206	5.263	4.154	1.143	28641
1500	2700	8232.66	0.0000000	44.267	1.275300	4.3040	12386	5.313	4.200	1.136	29070
1500	2750	8379.78	0.0000000	45.100	1.304500	4.4040	12566	5.363	4.246	1.129	29500
1500	2800	8526.90	0.0000000	45.933	1.333700	4.5040	12746	5.413	4.292	1.122	29929
1500	2850	8674.02	0.0000000	46.767	1.362900	4.6040	12926	5.463	4.338	1.115	30358
1500	2900	8821.14	0.0000000	47.600	1.392100	4.7040	13106	5.513	4.384	1.108	30787
1500	2950	8968.26	0.0000000	48.433	1.421300	4.8040	13286	5.563	4.430	1.101	31216
1500	3000	9115.38	0.0000000	49.267	1.450500	4.9040	13466	5.613	4.476	1.094	31645
1500	3050	9262.50	0.0000000	50.100	1.479700	5.0040	13646	5.663	4.522	1.087	32074
1500	3100	9409.62	0.0000000	50.933	1.508900	5.1040	13826	5.713	4.568	1.080	32503
1500	3150	9556.74	0.0000000	51.767	1.538100	5.2040	14006	5.763	4.614	1.073	32932
1500	3200	9703.86	0.0000000	52.600	1.567300	5.3040	14186	5.813	4.660	1.066	33361
1500	3250	9850.98	0.0000000	53.433	1.596500	5.4040	14366	5.863	4.706	1.059	33790
1500	3300	10000.00	0.0000000	54.267	1.625700	5.5040	14546	5.913	4.752	1.052	34219
1500	3350	10147.12	0.0000000	55.100	1.654900	5.6040	14726	5.963	4.798	1.045	34648
1500	3400	10294.24	0.0000000	55.933	1.684100	5.7040	14906	6.013	4.844	1.038	35077
1500	3450	10441.36	0.0000000	56.767	1.713300	5.8040	15086	6.063	4.890	1.031	35506
1500	3500	10588.48	0.0000000	57.600	1.742500	5.9040	15266	6.113	4.936	1.024	35935
150											

## EQUILIBRIUM HYDROGEN (OUTPUT FROM ET PROGRAMS)

PRESSURE PSIA	TEMPERATURE DEG. R	ENTHALPY BTU/LB	DENSITY LB/CU.FT	ENTRAPPY BTU/LB-R	CONDUCTIVITY BTU/H -FT-R	VISCOSITY LB-M /SQ.FT *10**10	VEL.SOUND FT/S	C-P-R BTU/LB-R	C-V BTU/LB-R	CP/CV RATIO	L FACTOR
4500	25	-5.75	5.5473082	1.366	0.091561	2.3119	5968	1.901	1.575	1.207	2195
4500	30	-5.75	5.5473082	1.366	0.091561	2.3119	5968	1.901	1.575	1.207	2195
4500	35	-5.75	5.5473082	1.366	0.091561	2.3119	5968	1.901	1.575	1.207	2195
4500	40	33.72	5.5323171	1.411	0.093500	2.2159	5945	1.946	1.611	1.208	2278
4500	45	44.46	5.4405682	1.662	0.099812	1.8054	5813	2.095	1.809	1.217	2756
4500	50	56.96	5.3648192	1.914	0.104504	1.5407	5681	2.643	2.161	1.223	3218
4500	55	71.02	5.2810703	2.173	0.107840	1.3480	5550	3.054	2.498	1.222	3654
4500	60	87.39	5.1973214	2.463	0.109420	1.1935	5418	3.470	2.840	1.222	4048
4500	65	105.79	5.1133724	2.753	0.110400	1.0948	5301	3.829	3.128	1.224	4404
4500	70	125.52	5.0298235	3.043	0.110920	1.0109	5184	4.104	3.334	1.231	4712
4500	75	146.72	4.9409797	3.321	0.111000	0.9355	5067	4.380	3.540	1.237	4972
4500	80	169.20	4.8487393	3.610	0.111700	0.8706	4950	4.625	3.625	1.248	5185
4500	85	192.21	4.7566989	3.892	0.109860	0.8188	4874	4.853	3.693	1.260	5354
4500	90	215.67	4.6642566	4.174	0.108960	0.7703	4797	4.743	3.725	1.273	5484
4500	95	239.54	4.5720182	4.416	0.107720	0.7326	4721	4.759	3.632	1.289	5578
4500	100	262.41	4.4791778	4.657	0.106480	0.6963	4645	4.777	3.659	1.305	5636
4500	110	310.85	4.2978369	5.123	0.103494	0.6385	4559	4.693	3.497	1.342	5673
4500	120	357.05	4.1265053	5.519	0.100528	0.5944	4474	4.575	3.315	1.380	5711
4500	130	402.27	3.9542731	5.887	0.097499	0.5615	4435	4.445	3.139	1.416	5669
4500	140	446.02	3.7824912	6.211	0.094470	0.5287	4397	4.313	2.979	1.448	5627
4500	150	488.45	3.6280266	6.504	0.092901	0.5052	4359	4.161	2.818	1.484	5597
4500	160	530.10	3.4855261	6.776	0.091332	0.4881	4349	4.068	2.694	1.508	5567
4500	170	569.77	3.3483206	7.024	0.090207	0.4744	4340	3.955	2.578	1.534	5533
4500	180	602.73	3.1993333	7.204	0.088946	0.4608	4331	3.843	2.459	1.563	5495
4500	190	639.74	3.0852222	7.366	0.087338	0.4516	4337	3.797	2.323	1.597	5484
4500	200	676.76	2.9711111	7.527	0.086730	0.4454	4344	3.752	2.367	1.572	5474
4500	250	861.42	2.4976944	8.336	0.091692	0.4684	4418	3.637	2.346	1.550	5420
4500	300	1046.10	2.1500000	9.035	0.094115	0.4755	4528	3.598	2.304	1.569	5439
4500	350	1222.23	1.8950000	9.571	0.096943	0.4822	4652	3.574	2.311	1.482	5484
4500	400	1400.44	1.6939444	10.080	0.100926	0.4942	4787	3.551	2.266	1.456	5554
4500	450	1578.99	1.5322500	10.483	0.105242	0.5090	4934	3.550	2.266	1.440	5625
4500	500	1757.50	1.4504500	10.705	0.109950	0.5255	5082	3.549	2.292	1.424	5714
4500	550	1932.98	1.3423500	10.983	0.114290	0.5453	5233	3.540	2.299	1.417	5751
4500	600	2108.46	1.2342500	11.260	0.118630	0.5650	5384	3.532	2.250	1.410	5788
4500	650	2293.42	1.1075500	11.815	0.127310	0.6045	5682	3.514	2.234	1.403	5862
4500	700	2459.42	1.0759500	11.815	0.127310	0.6045	5682	3.514	2.234	1.403	5862
4500	750	2610.38	0.9953600	12.370	0.135930	0.6440	5971	3.498	2.298	1.381	6095
4500	800	2761.34	0.9153200	12.740	0.144670	0.6835	6222	3.499	2.301	1.399	6039
4500	850	2912.30	0.8567000	13.110	0.153350	0.7231	6473	3.500	2.305	1.398	6083
4500	900	3063.26	0.8000000	13.480	0.162000	0.7626	6724	3.504	2.314	1.394	6238
4500	950	3214.22	0.7433250	13.850	0.170650	0.8021	6975	3.525	2.359	1.389	6393
4500	1000	3365.18	0.6866500	14.220	0.179300	0.8416	7226	3.546	2.380	1.381	6548
4500	1050	3516.14	0.6300000	14.590	0.187950	0.8811	7477	3.567	2.401	1.374	6703
4500	1100	3667.10	0.5733250	14.960	0.196600	0.9206	7728	3.588	2.422	1.366	6858
4500	1150	3818.06	0.5166500	15.330	0.205250	0.9601	7979	3.609	2.443	1.358	7013
4500	1200	3969.02	0.4600000	15.700	0.213900	1.0000	8230	3.630	2.464	1.350	7168
4500	1250	4120.00	0.4033250	16.070	0.222550	1.0400	8481	3.651	2.485	1.342	7323
4500	1300	4271.00	0.3466500	16.440	0.231200	1.0800	8732	3.672	2.506	1.334	7478
4500	1350	4422.00	0.2900000	16.810	0.239850	1.1200	8983	3.693	2.527	1.326	7633
4500	1400	4573.00	0.2333250	17.180	0.248500	1.1600	9234	3.714	2.548	1.318	7788
4500	1450	4724.00	0.1766500	17.550	0.257150	1.2000	9485	3.735	2.569	1.310	7943
4500	1500	4875.00	0.1200000	17.920	0.265800	1.2400	9736	3.756	2.590	1.302	8098
4500	1550	5026.00	0.0633250	18.290	0.274450	1.2800	9987	3.777	2.611	1.294	8253
4500	1600	5177.00	0.0066500	18.660	0.283100	1.3200	10238	3.798	2.632	1.286	8408
4500	1650	5328.00	0.0000000	19.030	0.291750	1.3600	10489	3.819	2.653	1.278	8563
4500	1700	5479.00	0.0000000	19.400	0.300400	1.4000	10740	3.840	2.674	1.270	8718
4500	1750	5630.00	0.0000000	19.770	0.309050	1.4400	10991	3.861	2.695	1.262	8873
4500	1800	5781.00	0.0000000	20.140	0.317700	1.4800	11242	3.882	2.716	1.254	9028
4500	1850	5932.00	0.0000000	20.510	0.326350	1.5200	11493	3.903	2.737	1.246	9183
4500	1900	6083.00	0.0000000	20.880	0.335000	1.5600	11744	3.924	2.758	1.238	9338
4500	1950	6234.00	0.0000000	21.250	0.343650	1.6000	11995	3.945	2.779	1.230	9493
4500	2000	6385.00	0.0000000	21.620	0.352300	1.6400	12246	3.966	2.800	1.222	9648
4500	2050	6536.00	0.0000000	21.990	0.360950	1.6800	12497	3.987	2.821	1.214	9803
4500	2100	6687.00	0.0000000	22.360	0.369600	1.7200	12748	3.999	2.842	1.206	9958
4500	2150	6838.00	0.0000000	22.730	0.378250	1.7600	12999	4.020	2.863	1.198	10113
4500	2200	6989.00	0.0000000	23.100	0.386900	1.8000	13250	4.041	2.884	1.190	10268
4500	2250	7140.00	0.0000000	23.470	0.395550	1.8400	13501	4.062	2.905	1.182	10423
4500	2300	7291.00	0.0000000	23.840	0.404200	1.8800	13752	4.083	2.926	1.174	10578
4500	2350	7442.00	0.0000000	24.210	0.412850	1.9200	14003	4.104	2.947	1.166	10733
4500	2400	7593.00	0.0000000	24.580	0.421500	1.9600	14254	4.125	2.968	1.158	10888
4500	2450	7744.00	0.0000000	24.950	0.430150	2.0000	14505	4.146	2.989	1.150	11043
4500	2500	7895.00	0.0000000	25.320	0.438800	2.0400	14756	4.167	3.010	1.142	11198
4500	2550	8046.00	0.0000000	25.690	0.447450	2.0800	15007	4.188	3.031	1.134	11353
4500	2600	8197.00	0.0000000	26.060	0.456100	2.1200	15258	4.209	3.052	1.126	11508
4500	2650	8348.00	0.0000000	26.430	0.464750	2.1600	15509	4.230	3.073	1.118	11663
4500	2700	8499.00	0.0000000	26.800	0.473400	2.2000	15760	4.251	3.094	1.110	11818
4500	2750	8650.00	0.0000000	27.170	0.482050	2.2400	16011	4.272	3.115	1.102	11973
4500	2800	8801.00	0.0000000	27.540	0.490700	2.2800	16262	4.293	3.136	1.094	12128
4500	2850	8952.00	0.0000000	27.910	0.499350	2.3200	16513	4.314	3.157	1.086	12283
4500	2900	9103.00	0.0000000	28.280	0.508000	2.3600	16764	4.335	3.178	1.078	12438
4500	2950	9254.00	0.0000000	28.650	0.516650	2.4000	17015	4.356	3.199	1.070	12593
4500	3000	9405.00	0.0000000	29.020	0.525300	2.4400	17266	4.377	3.220	1.062	12748
4500	3050	9556.00	0.0000000	29.390	0.533950	2.4800	17517	4.398	3.241	1.054	12903
4500	3100	9707.00	0.0000000	29.760	0.542600	2.5200	17768	4.419	3.262	1.046	13058
4500	3150	9858.00	0.0000000	30.130	0.551250	2.5600	18019	4.440	3.283	1.038	13213
4500	3200	10009.00	0.0000000	30.500	0.560000	2.6000	18270	4.461	3.304	1.030	13368
4500	3250	10160.00	0.0000000	30.870	0.568650	2.6400	18521	4.482	3.325	1.022	13523
4500	3300	10311.00	0.0000000	31.240	0.577300	2.6800	18772	4.503	3.346	1.014	13678
4500	3350	10462.00	0.0000000	31.610	0.585950	2.7200	19023	4.524	3.367	1.006	13833
4500	3400	10613.00	0.0000000	31.980	0.594600	2.7600	19274	4.545	3.388	1.000	13988
4500	3450	10764.00	0.0000000	32.350	0.603250	2.8000	19525	4.566	3.409	0.992	14143
4500	3500	10915.00	0.0000000	32.720	0.611900	2.8400	19776	4.587	3.430	0.984	14298
4500	3550	11066.00	0.0000000	33.090	0.620550	2.8800	20027	4.608	3.451	0.976	14453
4500	3600	11217.00	0.0000000	33.460	0.629200						

# APPENDIX B. PROGRAM LISTINGS: CDC AND IBM

	CDC	Page No.	IBM
Parahydrogen			
	PIENTH	53	PTENTH
	PTDENS	57	PTDENS
	PTENTR	61	PTENTR
	PTCOND	65	PTCOND
	PTVISC	68	PTVISC
	PTSOUN	72	PTSOUN
	PTCP, PTCV, PTGAMM	75	PTCP, PTCV, PTGAMM
	PTLFAC	80	PTLFAC
	TSATH	83	TSATH
	PSATH	84	PSATH
	PHTEMP	85	PHTEMP
	PHDENS	87	PHDENS
	PHENTR	91	PHENTR
	PHCOND	94	PHCOND
	PHVISC	98	PHVISC
	PHSOUN	103	PHSOUN
	PHCP, PHCV, PHGAMM	105	PHCP, PHCV, PHGAMM
	PHLFAC	111	PHLFAC
Equilibrium-hydrogen			
	ETENTH	115	ETENTH
	ETDENS	119	ETDENS
	ETENTR	124	ETENTR
	ETCOND	127	ETCOND
	ETVISC	131	ETVISC
	ETSOUN	134	ETSOUN
	ETCP, ETCV, ETGAMM	137	ETCP, ETCV, ETGAMM
	ETLFAC	142	ETLFAC
	ETSATH	146	ETSATH
	EPSATH	146	EPSATH
	EHTEMP	147	EHTEMP
	EHDENS	150	EHDENS
	EHENTR	153	EHENTR
	EHCOND	157	EHCOND
	EHVISC	160	EHVISC
	EHSOUN	165	EHSOUN
	EHCP, EHCV, EHGAMM	168	EHCP, EHCV, EHGAMM
	EHLFAC	173	EHLFAC

```

FUNCTION PTEMPH(PRES,TEMP)
COMMON/PTEMP/ML103)
DIMENSION LOC(29),JF(24),MX(24),BP(24),OP(24),BT(29),DT(24),PS(20)
1,ST(20),TL(10),MS(10)
DATA(ML1)1=1,93=10720,10750,10700,12690,12720,12750,1147
1300,14700,14810,17060,16960,19700,19330,19250,10720,
2,10720,10730,12710,12700,12700,14820,14810,14700,17020,17
3340,17030,12390,19940,19960,10720,10720,12730,12710,12730,12710,
3,4,12780,15020,14910,14850,14800,17550,17330,22560,21170,2
59520,10720,10720,10720,10720,11520,11500,11520,1236
60,12320,12310,12320,13260,13180,13150,13160,14250,14090,
4,17480,18400,14050,15400,15000,14900,14940,16700,16220,16030,160
830,10500,17540,17200,17120,20660,19110,18560,18430,23400,
5,92130,20370,19960,12710,12340,12340,22300,12320,10720,10720,11
900,11950,11950,12370,12360,12350,12340,13390,13380,13260,11
1510,11510,12010,12370,12360,12350,12340,13390,13380,13260,11
6,13320,13210,14520,14330,14250,14210,14170,15900,15560,1
3350,15310,15250,17600,17060,16700,16620,16500,20030,1897
7,18090,18210,18020,23100,21400,20670,20210,19080,27390,2
8540,18080,22750,22250,22960,22800,27000,26000,152560,166
8,1740,3407,3524,5151,5272,6935,7056,9783,8981,10720,10
9,3760,3792,3771,3305,4401,5030,7,823,8626,2,835,9,851,12
10,1270,1202,1297,1335,1666,1608,9,267,1706,1724,1743,102,2,12
11,159,150,182,2209,4,221,2380,9,267,1706,1724,1743,102,2,12
12,1109,295)350,8,362,7,303,419,22,4,466,8,88,34,86,
DATA(ML1)1=109,295)350,8,362,7,303,419,22,4,466,8,88,34,86,
DATA(ML2)1=109,295)350,8,362,7,303,419,22,4,466,8,88,34,86,
DATA(ML3)1=109,295)350,8,362,7,303,419,22,4,466,8,88,34,86,
DATA(ML4)1=109,295)350,8,362,7,303,419,22,4,466,8,88,34,86,
DATA(ML5)1=109,295)350,8,362,7,303,419,22,4,466,8,88,34,86,
DATA(ML6)1=109,295)350,8,362,7,303,419,22,4,466,8,88,34,86,
DATA(ML7)1=109,295)350,8,362,7,303,419,22,4,466,8,88,34,86,
DATA(ML8)1=109,295)350,8,362,7,303,419,22,4,466,8,88,34,86,
DATA(ML9)1=109,295)350,8,362,7,303,419,22,4,466,8,88,34,86,
DATA(ML10)1=109,295)350,8,362,7,303,419,22,4,466,8,88,34,86,
DATA(ML11)1=109,295)350,8,362,7,303,419,22,4,466,8,88,34,86,
DATA(ML12)1=109,295)350,8,362,7,303,419,22,4,466,8,88,34,86,
DATA(ML13)1=109,295)350,8,362,7,303,419,22,4,466,8,88,34,86,
DATA(ML14)1=109,295)350,8,362,7,303,419,22,4,466,8,88,34,86,
DATA(ML15)1=109,295)350,8,362,7,303,419,22,4,466,8,88,34,86,
DATA(ML16)1=109,295)350,8,362,7,303,419,22,4,466,8,88,34,86,
DATA(ML17)1=109,295)350,8,362,7,303,419,22,4,466,8,88,34,86,
DATA(ML18)1=109,295)350,8,362,7,303,419,22,4,466,8,88,34,86,
DATA(ML19)1=109,295)350,8,362,7,303,419,22,4,466,8,88,34,86,
DATA(ML20)1=109,295)350,8,362,7,303,419,22,4,466,8,88,34,86,
DATA(ML21)1=109,295)350,8,362,7,303,419,22,4,466,8,88,34,86,
DATA(ML22)1=109,295)350,8,362,7,303,419,22,4,466,8,88,34,86,
DATA(ML23)1=109,295)350,8,362,7,303,419,22,4,466,8,88,34,86,
DATA(ML24)1=109,295)350,8,362,7,303,419,22,4,466,8,88,34,86,
DATA(ML25)1=109,295)350,8,362,7,303,419,22,4,466,8,88,34,86,
DATA(ML26)1=109,295)350,8,362,7,303,419,22,4,466,8,88,34,86,
DATA(ML27)1=109,295)350,8,362,7,303,419,22,4,466,8,88,34,86,
DATA(ML28)1=109,295)350,8,362,7,303,419,22,4,466,8,88,34,86,
DATA(ML29)1=109,295)350,8,362,7,303,419,22,4,466,8,88,34,86,
DATA(ML30)1=109,295)350,8,362,7,303,419,22,4,466,8,88,34,86,
DATA(ML31)1=109,295)350,8,362,7,303,419,22,4,466,8,88,34,86,
DATA(ML32)1=109,295)350,8,362,7,303,419,22,4,466,8,88,34,86,
DATA(ML33)1=109,295)350,8,362,7,303,419,22,4,466,8,88,34,86,
DATA(ML34)1=109,295)350,8,362,7,303,419,22,4,466,8,88,34,86,
DATA(ML35)1=109,295)350,8,362,7,303,419,22,4,466,8,88,34,86,
DATA(ML36)1=109,295)350,8,362,7,303,419,22,4,466,8,88,34,86,
DATA(ML37)1=109,295)350,8,362,7,303,419,22,4,466,8,88,34,86,
DATA(ML38)1=109,295)350,8,362,7,303,419,22,4,466,8,88,34,86,
DATA(ML39)1=109,295)350,8,362,7,303,419,22,4,466,8,88,34,86,
DATA(ML40)1=109,295)350,8,362,7,303,419,22,4,466,8,88,34,86,
DATA(ML41)1=109,295)350,8,362,7,303,419,22,4,466,8,88,34,86,
DATA(ML42)1=109,295)350,8,362,7,303,419,22,4,466,8,88,34,86,
DATA(ML43)1=109,295)350,8,362,7,303,419,22,4,466,8,88,34,86,
DATA(ML44)1=109,295)350,8,362,7,303,419,22,4,466,8,88,34,86,
DATA(ML45)1=109,295)350,8,362,7,303,419,22,4,466,8,88,34,86,
DATA(ML46)1=109,295)350,8,362,7,303,419,22,4,466,8,88,34,86,
DATA(ML47)1=109,295)350,8,362,7,303,419,22,4,466,8,88,34,86,
DATA(ML48)1=109,295)350,8,362,7,303,419,22,4,466,8,88,34,86,
DATA(ML49)1=109,295)350,8,362,7,303,419,22,4,466
```

```

IFIP.LT.1.0) P=1.0
T=TEMP
IF(T.LT.90.0) GO TO 10
IF(T.LT.3000.0) GO TO 5
IF(T.GE.6000.0) T=5999.9999
IFIP.LT.30.0) GO TO 3
IFIP.LT.80.0) GO TO 2
IFIP.LT.500.0) GO TO 1
M1=25
GO TO 33
1 M1=2
M1=26
GO TO 33
2 M1=3
M1=27
GO TO 33
3 IF(P.LT.5.0) GO TO 4
M1=4
M1=29
GO TO 33
4 M1=5
M1=28
GO TO 33
5 IF(T.LT.100.0) GO TO 70
IF(T.LT.500.0) GO TO 6
M1=6
GO TO 33
6 M1=7
GO TO 33
70 IF(P.LT.1175.60) GO TO 8
IF(P.LT.2645.20) GO TO 7
M1=8
GO TO 33
7 M1=9
GO TO 33
8 IF(P.LT.527.84) GO TO 9
M1=10
GO TO 33
9 M1=11
GO TO 33
10 IF(P.LT.1175.60) GO TO 12
IF(P.LT.2645.20) GO TO 11
M1=12
GO TO 35
11 M1=13
GO TO 38
12 IF(T.GE.59.4) GO TO 15
M1=14
IF(P.GE.107.6385) GO TO 30
DO 13 I=2120
IF(P-PS(I)) 14,14,13
13 CONTINUE
I=20
14 T=TS(I-1)+(TS(I)-TS(I-1))*(P-PS(I-1))/(PS(I)-PS(I-1))
IF(T.GE.TM) GO TO 30
GO TO 23
15 IF(P.LT.293.92) GO TO 20

```

```

7342.7,325.1,444.5,398.7,381.9,465.8,457.3,448.4,-36.57,-635.35,58
8,-24.27,11.37,46.52,-10.41,24.51,59.14,5.035,39.1,73.14,22.05,54.9
99.88,32,40.52,72.09,104.7,59.98,90.22,122.80,6,109.3,140.1,102.2/
DATAAD/129.1,159.1,-85.55,-76.17,-66.88,-57.67,-48.54,-39.65,-76.14
1,-67.02,-57.06,-48.74,-39.63,-30.42,-65.46,-56.63,-47.73,-38.82,-2
39.88,-20.81,-53.51,-45.09,-36.51,-27.86,-19.15,-10.41,-40.29,-32.3
28.23,-15.89,-7.47,1.17,-25.74,-18.56,-10.91,-2.96,5.14,13.54,-9
4.86,-3.59,3.41,10.88,18.6,26.64,7.34,12.46,18.68,25.57,32.85,40.42
5.25,89.29,54.34,83.41,84.47,82.54,89.45,69.47,61.51,79.57,23.63,43
6.70,29,66.61,66.57,69.53,74.12,79.68,86.88,34,86.3,87.94,91.61,96
7.51,102.2,-129.4,-124.6,-119.8,-115.5,-110.3,-105.5,-100.8,-96.08,-
891.37,-119.4,-114.9,-110.4,-105.8,-101.2,-96.51,-91.88,-87.21,-82.
941,-107.4,-103.4,-99.26,-94.98,-90.6,-86.19,-81.71,-77.23,-72.58/
DATAEE/92.77,-89.71,-86.23,-82.46,-78.47,-74.37,-70.19,-65.93,-61
1.48,-73.53,-72.8,-70.77,-67.93,-64.6,-61.57,-57.2,-53.28,-49.11,-41.
228,-49.57,-51.87,-50.91,-48.74,-45.9,-42.7,-39.24,-35.44,39,-18.9
3,-26.49,-30.41,-30.39,-28.88,-26.55,-23.74,-20.45,-16.52,-12.58,-8.
41,34.66,33.21,32.38,32.04,32.06,32.49,88.56,79.51,72.99,68.32,65.0
51,62.69,61.11,60.1,59.63,126.4,117.8,109.2,103.8,98.33,95.1,91.88,
690.11,81.34,-30.39,-29.64,-28.88,-27.72,-26.59,-25.15,-23.74,-22.1
77,-20.45,-23.63,-23.33,-22.72,-21.84,-20.77,-19.57,-18.24,-16.82,-
815.17,-16.47,-16.59,-16.27,-15.65,-14.8,-13.76,-12.58,-11.27,-9.88
9,-8.89,-9.51,-9.56,-9.23,-8.6,-7.75,-6.72,-5.57,-4.14,-2.85,-2.07/
DATAFF/2.56,-2.55,-2.18,-1.55,-.7,31.6,7.60,5.74,4.76,4.38,4.45
1.48,5.5,5.6,34.7,34.16,7,13.93,12.37,11.57,11.31,11.45,11.86,12.53,
213.52,26.21,22.5,20.28,19.02,18.39,18.24,18.43,18.89,19.7,36.36,31
3.44,28.52,26.72,25.7,25.22,25.15,25.4,25.89,46.52,40.72,37.01,34.6
46,32.21,32.38,32.04,32.06,32.49,95.17,80.15,65.54,53.23,44.02,37.3
50,32.55,28.95,26.21,15.7,18.4,19.2,37.61,0.5,70.96,62.55,55.86,50.6
62,46.52,132.6,123.2,113.6,104.9,94.83,86.45,79.09,72.87,67.54,47.7
7,139.7,131.4,123.3,115.3,107.6,100.5,94.17,88.56,161.6,154.5,147.3
8,140.2,133.2,126.3,119.8,113.7,107.5,107.5,174.7,168.7,162.6,156.6,150.5
9,144.5,138.5,132.4,126.4,177.4,161.6,143.4,121.8,95.2,186.3,111.7/
DATAAG/155.4,136.8,115.7,195.1,181.6,166.8,150.5,132.6,120.4,191.4,
1177.9,163.3,147.7,212.9,201.2,188.7,175.5,161.6,222.2,210.3,198.5,
2186.6,174.7,-30.41,-30.63,-30.67,-30.59,-30.39,-22.5,-23.09,-23.44
3,-23.6,-23.63,-13.86,-14.96,-15.7,-16.18,-16.47,-4.37,-6.14,-7.4,-
48.28,-8.89,6.14,3.46,1.54,16,-85.17,79.13,93.11,18.9,17.7,68.30-
552,25,28,21,52,18,77,16,7,44,02,37,38,32,55,28,95,26,21,-26,40,-27
6,26,-27,92,-28,45,-28,92,-29,3,29,62,-29,88,-30,1,-30,28,-30,41,-
721,02,-22,11,-23,-23,75,-24,38,-24,9,-25,36,-25,73,-26,06,-26,32,
8-26,46,-14,94,-16,45,-17,67,-18,68,-19,53,-20,25,-20,85,-21,37,-21
9.81,-22,19,-22,5,-8,03,-10,16,-11,84,-13,21,-14,34,-15,28,-16,09/
DATAHH/16.77,-17.35,-17.85,-18.18,-01,-3.05,-5.37,-7.22,-8.72,-9,
196,-11.01,-11.9,-12.66,-13.31,-13.86,9.41,5.12,1.87,-.61,-2.6,-4.2
23,-5.58,-6.72,-7.69,-8.52,-9.12,20.71,14.43,10.6,72,8.11,99,.26
3,-1.19,-2.42,-3.47,-4.37,33.45,25.24,19.25,14.8,11.45,8.74,6.54,4.
471,3,17,1.87,88,45,95,36,79,29,44,23,8,19,44,16,07,13,29,11,02,9,
512,7,51,6,14,56,31,47,94,39,94,33,35,28,09,23,89,20,51,17,76,15,44
6,13,49,11,96,66,66,58,21,50,23,43,14,37,17,32,25,28,21,24,89,22,11
7,19,78,17,79,74,56,67,32,59,73,52,62,46,26,40,81,36,2,32,35,29,11,
826,37,24,15,82,45,75,41,68,34,61,5,55,11,49,35,44,34,40,03,36,35,3
93,21,30,52,80,8,82,65,76,12,69,66,63,44,57,66,52,4,78,43,74/
DATAII/40.24,37.27,95.17,89.16,83.15,77.23,71.38,65.54,60.61,55.69
1,51.39,47.7,44.02,104.9,98.01,90.23,81.37,71.12,59.16,45.59,31.88,
220.95,113.3,107.3,100.8,93.63,85.67,76.79,66.95,56.39,45.95,120.4,
3115.8,110.2,104.2,97.75,90.73,83.18,75.1,66.66,127.6,123.6,118.7,1
413.4,107.6,102.1,95.85,89.29,82.45,134.8,130.4,126.1,121.8,116.4,1

```



```

5-3.58,3.41,10.88,18.6,26.64,7.34,12.46,18.68,25.57,32.85,40.42,25.
699.29,34.34,89.41,84.47,82.54,89.45,69.47,61.51,79.97,23.63,43.70.
729.66,61.66,57.69,53.74,12.79,68.86,88.34,86.3,87.94,91.61,96.51.
8102.2,-129.4,-124.6,-119.8,-115.0,-110.3,-105.5,-100.8,-96.08,-91.3
97,-119.4,-114.9,-110.4,-105.8,-101.2,-96.51,-91.08,-87.21,-82.41)
DATA(M(I),I=396,492)=107.4,103.4,99.26,94.98,90.6,86.19,-8
11.71,-77.23,-72.58,-68.71,-64.83,-60.95,-57.07,-53.19,-49.31,-45.43,-41.55,-37.67,-33.80,-29.92,-26.04,-22.16,-18.28,-14.40,-10.52,-6.64,-2.76,2.12,6.25,10.38,14.51,18.64,22.77,26.90,31.03,35.16,39.29,43.42,47.55,51.68,55.81,59.94,64.07,68.20,72.33,76.46,80.59,84.72,88.85,92.98,97.11,101.24,105.37,109.50,113.63,117.76,121.89,126.02,130.15,134.28,138.41,142.54,146.67,150.80,154.93,159.06,163.19,167.32,171.45,175.58,179.71,183.84,187.97,192.10,196.23,200.36,204.49,208.62,212.75,216.88,221.01,225.14,229.27,233.40,237.53,241.66,245.79,249.92,254.05,258.18,262.31,266.44,270.57,274.70,278.83,282.96,287.09,291.22,295.35,299.48,303.61,307.74,311.87,316.00,320.13,324.26,328.39,332.52,336.65,340.78,344.91,349.04,353.17,357.30,361.43,365.56,369.69,373.82,377.95,382.08,386.21,390.34,394.47,398.60,402.73,406.86,410.99,415.12,419.25,423.38,427.51,431.64,435.77,439.90,444.03,448.16,452.29,456.42,460.55,464.68,468.81,472.94,477.07,481.20,485.33,489.46,493.59,497.72,501.85,505.98,510.11,514.24,518.37,522.50,526.63,530.76,534.89,539.02,543.15,547.28,551.41,555.54,559.67,563.80,567.93,572.06,576.19,580.32,584.45,588.58,592.71,596.84,600.97,605.10,609.23,613.36,617.49,621.62,625.75,629.88,634.01,638.14,642.27,646.40,650.53,654.66,658.79,662.92,667.05,671.18,675.31,679.44,683.57,687.70,691.83,695.96,700.09,704.22,708.35,712.48,716.61,720.74,724.87,729.00,733.13,737.26,741.39,745.52,749.65,753.78,757.91,762.04,766.17,770.30,774.43,778.56,782.69,786.82,790.95,795.08,799.21,803.34,807.47,811.60,815.73,819.86,823.99,828.12,832.25,836.38,840.51,844.64,848.77,852.90,857.03,861.16,865.29,869.42,873.55,877.68,881.81,885.94,890.07,894.20,898.33,902.46,906.59,910.72,914.85,918.98,923.11,927.24,931.37,935.50,939.63,943.76,947.89,952.02,956.15,960.28,964.41,968.54,972.67,976.80,980.93,985.06,989.19,993.32,997.45,1001.58,1005.71,1009.84,1013.97,1018.10,1022.23,1026.36,1030.49,1034.62,1038.75,1042.88,1047.01,1051.14,1055.27,1059.40,1063.53,1067.66,1071.79,1075.92,1080.05,1084.18,1088.31,1092.44,1096.57,1100.70,1104.83,1108.96,1113.09,1117.22,1121.35,1125.48,1129.61,1133.74,1137.87,1142.00,1146.13,1150.26,1154.39,1158.52,1162.65,1166.78,1170.91,1175.04,1179.17,1183.30,1187.43,1191.56,1195.69,1199.82,1203.95,1208.08,1212.21,1216.34,1220.47,1224.60,1228.73,1232.86,1236.99,1241.12,1245.25,1249.38,1253.51,1257.64,1261.77,1265.90,1269.03,1273.16,1277.29,1281.42,1285.55,1289.68,1293.81,1297.94,1302.07,1306.20,1310.33,1314.46,1318.59,1322.72,1326.85,1330.98,1335.11,1339.24,1343.37,1347.50,1351.63,1355.76,1359.89,1364.02,1368.15,1372.28,1376.41,1380.54,1384.67,1388.80,1392.93,1397.06,1401.19,1405.32,1409.45,1413.58,1417.71,1421.84,1425.97,1430.10,1434.23,1438.36,1442.49,1446.62,1450.75,1454.88,1459.01,1463.14,1467.27,1471.40,1475.53,1479.66,1483.79,1487.92,1492.05,1496.18,1500.31,1504.44,1508.57,1512.70,1516.83,1520.96,1525.09,1529.22,1533.35,1537.48,1541.61,1545.74,1549.87,1554.00,1558.13,1562.26,1566.39,1570.52,1574.65,1578.78,1582.91,1587.04,1591.17,1595.30,1599.43,1603.56,1607.69,1611.82,1615.95,1620.08,1624.21,1628.34,1632.47,1636.60,1640.73,1644.86,1648.99,1653.12,1657.25,1661.38,1665.51,1669.64,1673.77,1677.90,1682.03,1686.16,1690.29,1694.42,1698.55,1702.68,1706.81,1710.94,1715.07,1719.20,1723.33,1727.46,1731.59,1735.72,1739.85,1743.98,1748.11,1752.24,1756.37,1760.50,1764.63,1768.76,1772.89,1777.02,1781.15,1785.28,1789.41,1793.54,1797.67,1801.80,1805.93,1810.06,1814.19,1818.32,1822.45,1826.58,1830.71,1834.84,1838.97,1843.10,1847.23,1851.36,1855.49,1859.62,1863.75,1867.88,1872.01,1876.14,1880.27,1884.40,1888.53,1892.66,1896.79,1900.92,1905.05,1909.18,1913.31,1917.44,1921.57,1925.70,1929.83,1933.96,1938.09,1942.22,1946.35,1950.48,1954.61,1958.74,1962.87,1967.00,1971.13,1975.26,1979.39,1983.52,1987.65,1991.78,1995.91,1999.04,2003.17,2007.30,2011.43,2015.56,2019.69,2023.82,2027.95,2032.08,2036.21,2040.34,2044.47,2048.60,2052.73,2056.86,2060.99,2065.12,2069.25,2073.38,2077.51,2081.64,2085.77,2089.90,2094.03,2098.16,2102.29,2106.42,2110.55,2114.68,2118.81,2122.94,2127.07,2131.20,2135.33,2139.46,2143.59,2147.72,2151.85,2155.98,2160.11,2164.24,2168.37,2172.50,2176.63,2180.76,2184.89,2189.02,2193.15,2197.28,2201.41,2205.54,2209.67,2213.80,2217.93,2222.06,2226.19,2230.32,2234.45,2238.58,2242.71,2246.84,2250.97,2255.10,2259.23,2263.36,2267.49,2271.62,2275.75,2279.88,2284.01,2288.14,2292.27,2296.40,2300.53,2304.66,2308.79,2312.92,2317.05,2321.18,2325.31,2329.44,2333.57,2337.70,2341.83,2345.96,2350.09,2354.22,2358.35,2362.48,2366.61,2370.74,2374.87,2379.00,2383.13,2387.26,2391.39,2395.52,2399.65,2403.78,2407.91,2412.04,2416.17,2420.30,2424.43,2428.56,2432.69,2436.82,2440.95,2445.08,2449.21,2453.34,2457.47,2461.60,2465.73,2469.86,2473.99,2478.12,2482.25,2486.38,2490.51,2494.64,2498.77,2502.90,2507.03,2511.16,2515.29,2519.42,2523.55,2527.68,2531.81,2535.94,2540.07,2544.20,2548.33,2552.46,2556.59,2560.72,2564.85,2568.98,2573.11,2577.24,2581.37,2585.50,2589.63,2593.76,2597.89,2602.02,2606.15,2610.28,2614.41,2618.54,2622.67,2626.80,2630.93,2635.06,2639.19,2643.32,2647.45,2651.58,2655.71,2659.84,2663.97,2668.10,2672.23,2676.36,2680.49,2684.62,2688.75,2692.88,2697.01,2701.14,2705.27,2709.40,2713.53,2717.66,2721.79,2725.92,2730.05,2734.18,2738.31,2742.44,2746.57,2750.70,2754.83,2758.96,2763.09,2767.22,2771.35,2775.48,2779.61,2783.74,2787.87,2792.00,2796.13,2800.26,2804.39,2808.52,2812.65,2816.78,2820.91,2825.04,2829.17,2833.30,2837.43,2841.56,2845.69,2849.82,2853.95,2858.08,2862.21,2866.34,2870.47,2874.60,2878.73,2882.86,2886.99,2891.12,2895.25,2899.38,2903.51,2907.64,2911.77,2915.90,2920.03,2924.16,2928.29,2932.42,2936.55,2940.68,2944.81,2948.94,2953.07,2957.20,2961.33,2965.46,2969.59,2973.72,2977.85,2981.98,2986.11,2990.24,2994.37,2998.50,3002.63,3006.76,3010.89,3015.02,3019.15,3023.28,3027.41,3031.54,3035.67,3039.80,3043.93,3048.06,3052.19,3056.32,3060.45,3064.58,3068.71,3072.84,3076.97,3081.10,3085.23,3089.36,3093.49,3097.62,3101.75,3105.88,3110.01,3114.14,3118.27,3122.40,3126.53,3130.66,3134.79,3138.92,3143.05,3147.18,3151.31,3155.44,3159.57,3163.70,3167.83,3171.96,3176.09,3180.22,3184.35,3188.48,3192.61,3196.74,3200.87,3205.00,3209.13,3213.26,3217.39,3221.52,3225.65,3229.78,3233.91,3238.04,3242.17,3246.30,3250.43,3254.56,3258.69,3262.82,3266.95,3271.08,3275.21,3279.34,3283.47,3287.60,3291.73,3295.86,3300.00,3304.13,3308.26,3312.39,3316.52,3320.65,3324.78,3328.91,3333.04,3337.17,3341.30,3345.43,3349.56,3353.69,3357.82,3361.95,3366.08,3370.21,3374.34,3378.47,3382.60,3386.73,3390.86,3394.99,3399.12,3403.25,3407.38,3411.51,3415.64,3419.77,3423.90,3428.03,3432.16,3436.29,3440.42,3444.55,3448.68,3452.81,3456.94,3461.07,3465.20,3469.33,3473.46,3477.59,3481.72,3485.85,3489.98,3494.11,3498.24,3502.37,3506.50,3510.63,3514.76,3518.89,3523.02,3527.15,3531.28,3535.41,3539.54,3543.67,3547.80,3551.93,3556.06,3560.19,3564.32,3568.45,3572.58,3576.71,3580.84,3584.97,3589.10,3593.23,3597.36,3601.49,3605.62,3609.75,3613.88,3618.01,3622.14,3626.27,3630.40,3634.53,3638.66,3642.79,3646.92,3651.05,3655.18,3659.31,3663.44,3667.57,3671.70,3675.83,3679.96,3684.09,3688.22,3692.35,3696.48,3700.61,3704.74,3708.87,3712.99,3717.12,3721.25,3725.38,3729.51,3733.64,3737.77,3741.90,3746.03,3750.16,3754.29,3758.42,3762.55,3766.68,3770.81,3774.94,3779.07,3783.20,3787.33,3791.46,3795.59,3799.72,3803.85,3807.98,3812.11,3816.24,3820.37,3824.50,3828.63,3832.76,3836.89,3841.02,3845.15,3849.28,3853.41,3857.54,3861.67,3865.80,3869.93,3874.06,3878.19,3882.32,3886.45,3890.58,3894.71,3898.84,3902.97,3907.10,3911.23,3915.36,3919.49,3923.62,3927.75,3931.88,3936.01,3940.14,3944.27,3948.40,3952.53,3956.66,3960.79,3964.92,3969.05,3973.18,3977.31,3981.44,3985.57,3989.70,3993.83,3997.96,4002.09,4006.22,4010.35,4014.48,4018.61,4022.74,4026.87,4031.00,4035.13,4039.26,4043.39,4047.52,4051.65,4055.78,4059.91,4064.04,4068.17,4072.30,4076.43,4080.56,4084.69,4088.82,4092.95,4097.08,4101.21,4105.34,4109.47,4113.60,4117.73,4121.86,4125.99,4130.12,4134.25,4138.38,4142.51,4146.64,4150.77,4154.90,4159.03,4163.16,4167.29,4171.42,4175.55,4179.68,4183.81,4187.94,4192.07,4196.20,4200.33,4204.46,4208.59,4212.72,4216.85,4220.98,4225.11,4229.24,4233.37,4237.50,4241.63,4245.76,4249.89,4254.02,4258.15,4262.28,4266.41,4270.54,4274.67,4278.80,4282.93,4287.06,4291.19,4295.32,4299.45,4303.58,4307.71,4311.84,4315.97,4320.10,4324.23,4328.36,4332.49,4336.62,4340.75,4344.88,4349.01,4353.14,4357.27,4361.40,4365.53,4369.66,4373.79,4377.92,4382.05,4386.18,4390.31,4394.44,4398.57,4402.70,4406.83,4410.96,4415.09,4419.22,4423.35,4427.48,4431.61,4435.74,4439.87,4444.00,4448.13,4452.26,4456.39,4460.52,4464.65,4468.78,4472.91,4477.04,4481.17,4485.30,4489.43,4493.56,4497.69,4501.82,4505.95,4510.08,4514.21,4518.34,4522.47,4526.60,4530.73,4534.86,4538.99,4543.12,4547.25,4551.38,4555.51,4559.64,4563.77,4567.90,4572.03,4576.16,4580.29,4584.42,4588.55,4592.68,4596.81,4600.94,4605.07,4609.20,4613.33,4617.46,4621.59,4625.72,4629.85,4633.98,4638.11,4642.24,4646.37,4650.50,4654.63,4658.76,4662.89,4667.02,4671.15,4675.28,4679.41,4683.54,4687.67,4691.80,4695.93,4699.06,4703.19,4707.32,4711.45,4715.58,4719.71,4723.84,4727.97,4732.10,4736.23,4740.36,4744.49,4748.62,4752.75,4756.88,4761.01,4765.14,4769.27,4773.40,4777.53,4781.66,4785.79,4789.92,4794.05,4798.18,4802.31,4806.44,4810.57,4814.70,4818.83,4822.96,4827.09,4831.22,4835.35,4839.48,4843.61,4847.74,4851.87,4856.00,4860.13,4864.26,4868.39,4872.52,4876.65,4880.78,4884.91,4889.04,4893.17,4897.30,4901.43,4905.56,4909.69,4913.82,4917.95,4922.08,4926.21,4930.34,4934.47,4938.60,4942.73,4946.86,4950.99,4955.12,4959.25,4963.38,4967.51,4971.64,4975.77,4979.90,4984.03,4988.16,4992.29,4996.42,5000.55,5004.68,5008.81,5012.94,5017.07,5021.20,5025.33,5029.46,5033.59,5037.72,5041.85,5045.98,5050.11,5054.24,5058.37,5062.50,5066.63,5070.76,5074.89,5079.02,5083.15,5087.28,5091.41,5095.54,5099.67,5103.80,5107.93,5112.06,5116.19,5120.32,5124.45,5128.58,5132.71,5136.84,5140.97,5145.10,5149.23,5153.36,5157.49,5161.62,5165.75,5169.88,5174.01,5178.14,5182.27,5186.40,5190.53,5194.66,5198.79,5202.92,5207.05,5211.18,5215.31,5219.44,5223.57,5227.70,5231.83,5235.96,5240.09,5244.22,5248.35,5252.48,5256.61,5260.74,5264.87,5269.00,5273.13,5277.26,5281.39,5285.52,5289.65,5293.78,5297.91,5302.04,5306.17,5310.30,5314.43,5318.56,5322.69,5326.82,5330.95,5335.08,5339.21,5343.34,5347.47,5351.60,5355.73,5359.86,5363.99,5368.12,5372.25,5376.38,5380.51,5384.64,5388.77,5392.90,5397.03,5401.16,5405.29,5409.42,5413.55,5417.68,5421.81,5425.94,5430.07,5434.20,5438.33,5442.46,5446.59,5450.72,5454.85,5458.98,5463.11,5467.24,5471.37,5475.50,5479.63,5483.76,5487.89,5492.02,5496.15,5500.28,5504.41,5508.54,5512.67,5516.80,5520.93,5525.06,5529.19,5533.32,5537.45,5541.58,5545.71,5549.84,5553.97,5558.10,5562.23,5566.36,5570.49,5574.62,5578.75,5582.88,5587.01,5591.14,5595.27,5599.40,5603.53,5607.66,5611.79,5615.92,5620.05,5624.18,5628.31,5632.44,5636.57,5640.70,5644.83,5648.96,5653.09,5657.22,5661.35,5665.48,5669.61,5673.74,5677.87,5682.00,5686.13,5690.26,5694.39,5698.52,5702.65,5706.78,5710.91,5715.04,5719.17,5723.30,5727.43,5731.56,5735.69,5739.82,5743.95,5748.08,5752.21,5756.34,5760.47,5764.60,5768.73,5772.86,5776.99,5781.12,5785.25,5789.38,5793.51,5797.64,5801.77,5805.90,5810.03,5814.16,5818.29,5822.42,5826.55,5830.68,5834.81,5838.94,5843.07,5847.20,5851.33,5855.46,5859.59,5863.72,5867.85,5871.98,5876.11,5880.24,5884.37,5888.50,5892.63,5896.76,5900.89,5905.02,5909.15,5913.28,5917.41,5921.54,5925.67,5929.80,5933.93,5938.06,5942.19,5946.32,5950.45,5954.58,5958.71,5962.84,5966.97,5971.10,5975.23,5979.36,5983.49,5987.62,5991.75,5995.88,6000.01,6004.14,6008.27,6012.40,6016.53,6020.66,6024.79,6028.92,6033.05,6037.18,6041.31,6045.44,6049.57,6053.70,6057.83,6061.96,6066.09,6070.22,6074.35,6078.48,6082.61,6086.74,6090.87,6095.00,6099.13,6103.26,6107.39,6111.52,6115.65,6119.78,6123.91,6128.04,6132.17,6136.30,6140.43,6144.56,6148.69,6152.82,6156.95,6161.08,6165.21,6169.34,6173.47,6177.60,6181.73,6185.86,6189.99,6194.12,6198.25,6202.38,6206.51,6210.64,6214.77,6218.90,6223.03,6227.16,6231.29,6235.42,6239.55,6243.68,6247.81,6251.94,6256.0
```

```

9.26.04,-25.48.74,-13.67,69.57,36.39,09.5,99,-3.23,-7.63,-10.52)
DATA(M(1),I=917,1823)=-12.65,-14.37,-15.78,-16.98,-18.9,-19.
169,-20.39,-21.02,83.09,77.17,70.3,61.77,50.17,31.98,12.48,3.55,-1.
289,-4.43,-6.93,-8.9,-10.49,-11.86,-13.03,-14.08,-14.96,89.04,84.56
3,79.86,72.84,65.52,56.54,44.99,30.6,17.92,9.94,4.89,1.51,-1.24,-3.
443,-5.22,-6.72,-8.03,96.98,90.77,86.16,81.07,75.42,69.01,61.59,52.
508,42.58,31.64,22.32,15.46,10.57,6.94,4.28,1.99,0.19,93.84,96.27,92.
6.24,87.8,83.15,77.97,72.25,65.86,58.68,50.67,42.06,33.59,26.31,20.
7.44,15.89,12.29,9.41,104.7,101.3,97.67,93.82,89.72,85.3,80.54,75.3
88,69.76,63.63,56.98,49.93,42.76,35.94,29.96,24.89,20.71,109.1,105.
99,102.6,99.07,95.49,91.5,87.5,82.95,78.39,73.16,67.98,62.13,56.27)
DATA(M(1),I=1024,1137)=59.2,44.8,38.79,33.45,27.1,21.3,15.0,9.0,0.8
14,3.57,3.0,0.8,0.97,6.72,9.43,11.8,14.8,18.9,23.5,28.6,34.0,40.0,46.
207,4.83,28.48,0.137,5.123,5.105,9.81,10.150,7.138,8.124,9.108,5
3.85,9.164,1.153,6.142,12.9,113.3,177.4,167.9,158.147,134.8,78.
4,62.3,5.4,0.0,0.09,0.78,3.61,41.9,29.1,98.8,90.1,78.9,60.1,27.8
5,106.7,99.5,91.1,80.6,65.2,114.1,107.8,100.8,92.8,83.1,120.8,115.2,
6189.2,102.5,95.19700,19330,19260,23000,22040,22610,27350,22.
78268,24730,21390,19948,19580,27180,23580,22660,25020,42210,35060,
88,26650,22560,21170,20520,30320,26640,25020,42210,35060,
931640,32960,28900,27090,26000,25260,40130,34330,331710,
DATA(M(1),I=1138,1183)=30130,29050,49050,41170,37530,35320,
133810,39610,449530,44710,41750,39690,71190,59200,53210,494
220,46750,82920,69950,62910,58310,55020,27100,123410,122100,
3,21520,31750,26350,24440,23950,37610,30000,27280,26070,44
4908,34480,30730,29050,53610,39900,34870,32610,63710,46340
5,39810,36850,.)
END

```

```

FUNCTION PTDEMS(PRES,TEMP)
DIMENSION PS(20),TS(20),JP(28),MX(28),LOC(30),BP(28),DP(28),BT(30)
1,DT(28),R(886)
COMMON/DEMSITY/R(886)
DATA(PS=1.022,2.4,0.0,14.25,43.69,99.128,151.165,176.,
1182,185,186.5,187.25,187.46875,187.506,187.6385)
DATA(TS=24.845,27.07,29.81,33.07,36.18,39.96,44.12,48.33,51.97,54.
179,56.72,57.80,58.57,59.99,59.18,59.29,59.34,59.35,59.356,59.4)
DATA(LOC=1,23,78,105,141,155,183,201,225,240,267,321,341,377,401,
1,425,437,453,469,494,534,546,586,682,722,752,800,848,866,878)
DATA(JP=2,5,3,4,2,4,3,6,3,3,4,4,3,3,4,4,5,8,4,5,12,5,3,6,6,6)
DATA(MX=0.3,1.2,0.2,1.2,1.1,1.1,2.2,1.1,2.2,3.6,2.3,10.3,14.4,4)
DATA(DP=0.208,100.0,0.0,0.0,0.0,0.0,2645.28,1469.6,881.76,0.0,
1,44,088,587.84,293.92,73.48,-14.696,293.92,36.74,-7.348,293.92,
2188,0.0,29.392,102.872,29.392)
DATA(DP=800,1200,0,200,0,1000,0,1000,0,7,0,1000,0,1175.68,
1,587.84,293.92,293.92,293.92,293.92,58.784,146.96,73.48,29.392,
2,73.48,36.74,14.696,73.48,10.0,7.348,1.4696,14.696,14.696,29.392/
1,36.0,27.0,27.0,108.0,108.0,57.6,86.4,86.4,72.0,72.0,72.0,
2,59.4,59.4,30.0,23.4,39.6,52.2,64.8,5000.0,5000.0)
DATA(DT=30.0,30.0,100.0,100.0,200.0,200.0,500.0,500.0,36.0,18.0,
1,9.0,9.0,9.0,14.4,7.2,7.2,7.2,7.2,7.2,3.6,3.6,7.2,1.8,1.8,0.6,0.5,4.3,6,
2,1.8,0.3,.)

```

```

FI=I
FF=FI
FP=1.0-F
TQ=FP*TL(I+1)+F*TL(I+2)
IF(T,GE,TQ) GO TO 33
PTENH=FP*HS(I+1)+F*HS(I+2)
RETURN
33 IF(T,LE,5000.)NI=N
FP=(P-8P(N))/DP(N)
IP=FP
IF(IP,GT,MX(N)) IP=MX(N)
FI=IP
FF=FP-FI
FP=1.0-F
FT=(T-BT(N1))/DT(N)
FI=FT
FF=FT-FI
FT=1.0-FF
I=I+JP(N)+IP*LOC(N1)
J=I+JP(N)
PTENH=FP*FT*H(I)+F*FT*H(I+1)+FP*FT*H(J)+F*FT*H(J+1)
RETURN
END

```

```

FUNCTION PTDEMS(PRES,TEMP)
DIMENSION PS(20),TS(20),JP(28),MX(28),LOC(30),BP(28),DP(28),BT(30)
1,DT(28),R(886)
DIMENSION AA(109),AB( 97),AC(108),AD(106),AE(106),AF(108),AG(101)
1, AH(111),AI( 41)
EQUIVALENCE( R,AA), ( R( 110),AB), ( R( 207),AC), ( R( 315),AD)
1, ( R( 421),AE), ( R( 527),AF), ( R( 635),AG), ( R( 736),AH)
2, ( R( 847),AI)
DATA PS(1.022,2.4,0.0,14.25,43.69,99.128,151.165,176.,
1182,185,186.5,187.25,187.46875,187.506,187.6385)
DATA TS(24.845,27.07,29.81,33.07,36.18,39.96,44.12,48.33,51.97,54.
179,56.72,57.80,58.57,59.99,59.18,59.29,59.34,59.35,59.356,59.4)
DATA LOC(1,23,78,105,141,155,183,201,225,240,267,321,341,377,401,
1,425,437,453,469,494,534,546,586,682,722,752,800,848,866,878)
DATA JP(2,5,3,4,2,4,3,6,3,3,4,4,3,3,4,4,5,8,4,5,12,5,3,6,6,6)
DATA MX(0.3,1.2,0.2,1.2,1.1,1.1,2.2,1.1,2.2,3.6,2.3,10.3,14.4,4)
DATA BP(0.208,100.0,0.0,0.0,0.0,0.0,2645.28,1469.6,881.76,0.0,
1,44,088,587.84,293.92,73.48,-14.696,293.92,36.74,-7.348,293.92,
2188,0.0,29.392,102.872,29.392)
DATA DP(800,1200,0,200,0,1000,0,1000,0,7,0,1000,0,1175.68,
1,587.84,293.92,293.92,293.92,293.92,58.784,146.96,73.48,29.392,
2,73.48,36.74,14.696,73.48,10.0,7.348,1.4696,14.696,14.696,29.392/
1,36.0,27.0,27.0,108.0,108.0,57.6,86.4,86.4,72.0,72.0,72.0,
2,59.4,59.4,30.0,23.4,39.6,52.2,64.8,5000.0,5000.0)
DATA DT(30.0,30.0,100.0,100.0,200.0,200.0,500.0,500.0,36.0,18.0,
1,9.0,9.0,9.0,14.4,7.2,7.2,7.2,7.2,7.2,3.6,3.6,7.2,1.8,1.8,0.6,0.5,4.3,6,
2,1.8,0.3,.)

```



```

P=PRES
IF(P.LT.1.0) P=1.0
T=TEMP
IF(T.LT.100.0) GO TO 8
IF(T.GE.1300.0) GO TO 4
IF(T.GE.1800.0) GO TO 2
IF(P.GE.800.0) GO TO 1
M=1
GO TO 33
1 M=2
GO TO 33
2 IF(P.GE.300.0) GO TO 3
M=3
GO TO 33
3 M=4
GO TO 33
4 IF(T.GE.2500.0) GO TO 6
IF(P.GE.100.0) GO TO 5
M=5
GO TO 33
5 M=6
GO TO 33
6 IF(T.GE.6000.0) T=5999.99999
IF(P.GE.10.0) GO TO 7
M=7
M1=30
GO TO 33
7 M=8
M1=20
GO TO 33
8 T=24.0+0.00317*P
IF(T.LT.72) T=72
IF(P.LT.881.76) GO TO 11
IF(P.LT.2645.20) GO TO 5
M=9
GO TO 33
9 IF(P.LT.1469.6) GO TO 10
M=10
GO TO 33
10 M=11
GO TO 33
11 IF(T.GE.59.4) GO TO 14
M=12
DO 12 I=2,28
IF(P.GE.107.6305) GO TO 33
IF(P-PS(I)) I=13,13,12
12 CONTINUE
I=20
13 TM=TS(I-1)*(TS(I)-TS(I-1))*(P-PS(I-1))/(PS(I)-PS(I-1))
IF(T.GE.TM) GO TO 24
GO TO 33
14 IF(T.LT.100.0) GO TO 16
IF(P.LT.132.204) GO TO 15
M=13
GO TO 33
15 M=14
GO TO 33
16 IF(P.LT.507.04) GO TO 17

```

```

N=15
GO TO 33
17 IF (T.LT.72.0) GO TO 23
   IF (T.LT.86.4) GO TO 20
   IF (P.LT.293.92) GO TO 18
N=16
GO TO 33
18 IF (P.LT.73.40) GO TO 19
N=17
GO TO 33
19 N=18
GO TO 33
20 IF (P.LT.293.92) GO TO 21
N=19
GO TO 33
21 IF (P.LT.36.74) GO TO 22
N=20
GO TO 33
22 N=21
GO TO 33
23 IF (P.LT.293.92) GO TO 24
N=22
GO TO 33
24 IF (P.LT.188.0) GO TO 25
N=23
GO TO 33
25 IF (P.GE.29.0) GO TO 27
   IF (P.LT.2.9392) GO TO 26
N=24
GO TO 33
26 N=25
GO TO 33
27 IF (T.GE.64.0) GO TO 29
   IF (P.GE.102.0) GO TO 28
N=26
GO TO 33
28 N=27
GO TO 33
29 N=28
33 IF (T.LE.5000.0) N1=N
   FP=(P-BP(N))/DP(N)
   IF (IP.GT.MX(N)) [P=MX(N)
   F=FP-IP
   FP=1.0-F
   FT=(1-BT(N1))/DT(N)
   IT=FT
   FF=FT-IT
   FT=1.0-FF
   I=IT*JP(N)+IP*LOC(N1)
   J=I*JPR(N)
   PTDETS=FP*FT*(I)+F*FT*(I+1)+FP*FF*(I)+F*FF*(J+1)
   RETURN
END

SUBROUTINE DATADENS
COMMON/DENSITY/R(866)
DATA ((R(I), I=1, 107)=0.00376, 0.007052, 0.006114, 0.005412, 0.004662, 0
4.959, 3.17, 3.313, 1.551, 2.329, 2.76, 3.014, 3.179, 1.358, 2.045, 2.546, 2.8
546, 3.044, 1.226, 1.007, 2.329, 2.674, 2.91, 6295, 2.42, 2.726, 2.849, 2.937
6.3, 005, 3.061, 3.11, 3.153, 3.191, 3.227, 3.259, 9330, 1.076, 1.265, 1.599,
72.262, 2.508, 2.659, 2.760, 2.85, 2.910, 2.976, 3.026, 8297, 9234, 1.03, 1.
8159, 1.322, 1.542, 1.835, 2.136, 2.356, 2.509, 2.610, 2.709, 759, 8323, 91
921, 1.001, 1.03, 1.222, 1.359, 1.523, 1.713, 1.916, 2.106, 2.267, 7053/
DATAAG/767, 8326, 9039, 9807, 1.066, 1.16, 1.265, 1.303, 1.513, 1.655, 1
1.803, 6621, 7161, 7728, 8331, 8976, 9656, 1.04, 1.12, 1.206, 1.299, 1.4
21.507, 6259, 6745, 725, 778, 8337, 8927, 9537, 0.019, 1.089, 1.163, 1
3.242, 1.325, 594, 1.6412, 6883, 7355, 7826, 8372, 8921, 9469, 1.005, 1
4.07, 1.135, 1.2, 8007, 43, 04849, 09854, 0.0, 0.000767, 04023, 08466,
5.1315, 1915, 000437, 03393, 07032, 1097, 1534, 000257, 0294, 06
6027, 09270, 1275, 000177, 02599, 05289, 0808, 1098, 000122, 0233
7.0472, 07177, 09714, 8.3E-5, 02112, 04266, 06465, 08719, 6.5E-5,
801932, 0301, 05888, 07931, 0.01172, 02363, 000111, 009736, 0198,
9.5E-5, 008154, 01648, 3.6E-5, 007021, 01414, 2.4E-5, 006166/
DATAAM/0124, 1.5E-5, 005498, 01104, 1.1E-5, 004962, 009954, 9.E-6
1.00421, 009063, 7.E-6, 004153, 008321, 2.2E-5, 003846, 007715, 1
2664, 2480, 0.0, 0.0, 1469, 2418, 3397, 0.0, 0.0, 1315, 2117, 3091,
3.4233, 5318, 0.0, 1195, 1891, 2684, 3626, 4811, 6115, 1098, 1717, 24
4.3166, 4051, 5124, 1017, 1578, 2183, 2841, 3566, 4387, 09486, 146
53.2009, 2592, 322, 3903, 08892, 1377, 1865, 2407, 295, 3565, 5712
61.727, 9725, 0.0, 0.0, 5124, 6559, 8514, 1116, 0.0, 4755, 5827, 73
729, 9604, 1.252, 1.718, 4307, 5333, 6477, 7994, 1.068, 1.534, 4145, 49
856, 5914, 706, 8535, 1.082, 3903, 4653, 5491, 6447, 7575, 8985, 373
94.4399, 5151, 5986, 6928, 802, 3565, 4181, 4998, 5616, 6487/
DATAAT/7358, 08892, 1865, 295, 4181, 5616, 7358, 08873, 1743, 273
11.3822, 5044, 6439, 07931, 1649, 2562, 3545, 461, 5814, 1.32E-5,
20373, 07436, 111, 2.97E-5, 00337, 06734, 1007, 5.14E-5, 03051, 0612
32, 09175, 0001453, 0001042, 0003599, 000124, 8.541E-5, 0003076, 9
4.95E-5, 6.714E-5, 0002542, 0./
P=PRES
IF (P.LT.1.0) P=1.0
T=TEMP
IF (T.LT.180.0) GO TO 8
   IF (T.GE.1300.0) GO TO 4
   IF (T.GE.480.0) GO TO 2
   IF (P.GE.800.) GO TO 1
N=1
GO TO 33
1 N=2
GO TO 33
2 IF (P.GE.300.0) GO TO 3
N=3
GO TO 33
3 N=4
GO TO 33
4 IF (T.GE.2500.0) GO TO 6
   IF (P.GE.100.0) GO TO 5
N=5
GO TO 33
5 N=6
GO TO 33
6 IF (T.GE.6000.0) T=5999.99999
   IF (P.GE.10.0) GO TO 7
N=7
N1=30
GO TO 33

```

```

1.4419.0...4053.0...3746.0...3483.0...3255.0...3056...2652.1.41.2.
215.2.924.3.396...2314.1.1791.979.2.584.3.052.1998.1.023.1.739.2.
3309.765...1766...9058.1.554.2.087.2.526...1577...847.1.407.1.905.2.
4325...1424.741.1.286.1.754.2.154.1297.6009.1.186.1.626.2.008.1
5192.631.1.021.516.1.881.1101.5865.1.029.1.421.1.769.1.021.1.548
69.9656.1.338.1.671.0953.5159.911.264.1.584...03747.03747.11
714...03125.03125.09302...02679.02679.07985...02345.02345.069
895...02885.02885.06224...01877.01877.05606...01706.01706.050
999...01565.01565.04677...01445.01445.04282.00464.3605.6912)
DATA(R(1),1)=108.2021=.9949.00341.3021.5825.8432.0026.2681..
15038.7325.003.2285.4441.6479.00161.2037.3972.581.00131..
21038.3592.5267.0011.1674.3279.4818.0009.1538.3017.4499..
300027.1422.2793.4116.0...01445.0...01252.0...01105.0...009892.0
4...008951.0...00817.8...007521.000267.1422.2793.4116.001089.
5.1235.2432.3592.00014...1092.2154.3187.00012.89785.1933.2
6864.9.8E-5.00864...1753.2601.8.1E-5...08101.1604.238216.9E-5.07
7459.1478.2196...0003009.0002256.0007521...000251.0001802.000
86272...000215...0001611.0005373...0001878.0001402.0004686...0001
9656...0001221.0004119...0001452.0001042...0003599.6.9E-6.07459)
DATA(R(1),1)=283.3071=.1478.2196.4.6E-6.06226.1236.1839.3.1E-6
1.05342.1061.1582.94E-7.04677.09301.13871.346E-6.04155.0827
22.1235...1.32E-5.0373.07436.1111.5.27.5.489.5.68.4.501.4.84.5.5.
3107.3.616.4.126.4.403.2.857.3.466.3.895.2.310.2.935.4.395.4.994.5.
443.5.27.4.533.4.743.4.886.3.958.4.27.4.501.3.307.3.752.4.059.2.69
59.3.243.3.616.2.226.2.796.3.236.1.886.2.435.2.857.1.639.2.15.2.588
61.453.1.924.2.319.5.033.5.112.5.183.4.816.4.91.4.994.4.558.4.876.
7.764.4.248.4.405.4.533.3.884.8.246.3.442.3.743.3.958.2.953.3
8.361.3.633.2.481.2.975.3.307.2.093.2.616.3.002.1.804.2.309.2.698.1
9.588.2.059.2.462.1.423.1.856.2.226.1.293.1.691.2.056.1.187.1.555)
END

SUBROUTINE SUB1
COMMON/DEMSITY/R(806)
DATA(R(1),1)=308.4111=1.886.1.1.1.441.1.754.1.026.1.344.1.639.962
17.1.2621.546...9076.1.189.1.653.4.742.4.853.4.946.5.031.4.43.4.584
24.709.4.816.4.024.4.279.4.417.4.558.3.165.3.778.0.05.4.248.1.43.2
3.988.3.595.3.88...0233.5581.1.189.1.804...015.503.1.051.1.588...0
4099.4591.945.1.423...0085.4231.8618.1.293...0042.3928.7943.1
5.187...0025...3669.7379.1.1...0015.3445.6898.1.026...0007.3249.
6.6483...9627...0001.3075...612.9076...07708.02568.1307.2384...0
7866...02262...1144.2079...06866.02822.1018.1844...05484.01828.
8.09179.1659...05004.31688.0836.1508...04602.01534.07677.138
93.3.087.3.986.4.105.3.447.3.646.3.792.2.913.226.3.442.2.323.2.76)
DATA(R(1),1)=412.5153=3.051.1.857.2.317.2.67.1.543.1.963.2.326.1.3
14.1.701.2.035.1.109.1.497.1.804.7859.1.309.1.857.6864.1.106.1.54
29.6141.9689.1.34.5581.8735.1.189.1675.3524.5577.7859.153.
3.3178...4955.6864...1409.2902...4479.6141.1307.2674.4127.5581.
4...03228...03224.09858.1675...02974.02971.09043.153...02756.02
5754...08359.1409...02568.02568.07819.1307.1.226.1.807.2.329.2.6
674.2.91.1.052.1.481.1.941.2.326.2.616.9378.1.279.1.656.2.019.2.32
73.8526.1.141.1.456.1.774.2.089.7859.1.047.1.309.1.583.1.857.099
875...2884...3279.461.6115.7847.9864.1.226.09478.1962.3063.42
964...5585...7052.8693.1.052.08981.1855.2878.3977.5164.0451)
DATA(R(1),1)=516.6201=7851.9388.0859.176.2717.3734.4417.59
172...7207...8526.08199.1675.2599.3524.455.5577.6718.7859...0
21936...01932.08888.08975...01756.01753.05323.08981...01615.01
3611.04802.08199.3384.3.422.3.5413.659.3.777.3.044.3.29.3.45.3.
4572.3.667.2.74.3.102.3.384.3.449.3.557.2.322.2.88.3.141.3.315.3.44

```

61

[illegible]

```

N1=30
GO TO 33
4 IF(T.LT.500.) GO TO 8
IF(P.LT.35.3) GO TO 6
IF(P.LT.353.) GO TO 5
N=5
GO TO 33
5 N=6
GO TO 33
6 IF(P.LT.3.53) GO TO 7
N=7
GO TO 33
7 N=8
GO TO 33
8 IF(P.LT.35.3) GO TO 10
IF(P.LT.353.) GO TO 9
N=9
GO TO 33
9 N=10
GO TO 33
10 IF(P.LT.3.53) GO TO 11
N=11
GO TO 33
11 N=12
GO TO 33
12 IF(T.GE.59.4) GO TO 18
T=20.84+0.88317*P
IF(T.LT.72) T=72
IF(P.LT.1763.52) GO TO 14
N=13
GO TO 33
14 IF(P.LT.734.8) GO TO 15
N=14
GO TO 33
15 N=18
IF(P.GE.187.6385) GO TO 33
DO 16 I=2,20
IF(P-PS(I)) 17,17,16
16 CONTINUE
I=20
17 T=TS(I-1)+(TS(I)-TS(I-1))*(P-PS(I-1))/(PS(I)-PS(I-1))
IF(T.LT.72) GO TO 33
GO TO 28
18 IF(P.LT.734.8) GO TO 28
IF(P.LT.1763.52) GO TO 19
N=13
GO TO 33
19 N=14
GO TO 33
20 IF(T.LT.98.) GO TO 23
IF(P.GE.67.16) GO TO 22
IF(P.LT.6.716) GO TO 21
N=16
GO TO 33
21 N=17
GO TO 33
22 N=15
GO TO 33

```

```

701,6.358,3.804,5.543,5.265,4.86,4.382,5.703,5.447,5.13,4.785,5.863
8.5.595,5.312,5.024,4.8,3.855,3.722,3.656,3.609,3.571,3.539,3.512,3
9.487,3.464,3.444,4.906,4.675,3.932,3.777,3.703,3.653,3.611,3.577,
DATAAF/3.548,3.521,3.505,5.011,4.874,4.555,3.994,3.832,3.751,3.695
1.3.651,3.615,3.584,3.566,5.117,4.995,4.795,4.666,4.043,3.881,3.797
2.3.737,3.69,3.652,3.628,5.222,5.000,4.929,4.723,4.411,4.081,3.926,
33.841,3.778,3.729,3.689,5.262,5.164,5.028,4.867,4.664,4.38,4.110,3.
4971,3.881,3.819,3.787,5.302,5.23,5.109,4.972,4.81,4.689,4.365,4.15
5.4.011,3.921,3.885,5.342,5.289,5.178,5.057,4.921,4.761,4.572,4.359
6.4.176,4.048,3.983,5.383,5.29,5.197,5.103,5.01,4.847,4.684,4.52,4
7.358,4.219,4.081,5.153,5.054,3.633,0.16,657,5.814,4.872,3.99,7.039,
86.324,5.749,5.117,7.335,6.694,6.213,5.793,7.631,6.997,6.555,6.071,
DATAAG/5.473,9.283,7.847,0.7,6.568,9.939,8.536,7.812,7.369,10.46,9
1.072,8.364,7.94,10.89,9.51,8.811,8.395,9.14,8.02,7.35,6.94,6.65,10
2.45,9.26,8.56,8.14,7.84,11.36,10.18,9.49,9.08,8.79,12.01,10.84,10.
315,9.75,9.46,12.53,11.36,10.68,10.27,9.99,12.97,11.79,11.11,10.71,
410.42,21.23,19.63,18.92,16.51,22.71,23.78,19.97,19.51,23.92,22.11,
521.34,28.9,26.84,24.22,91.22,3.27,23.25,05.24,08.23,53.82,29.
619,27.28,26.33,29.42,27.85,27.05,26.52,33.46,30.94,29.69,28.88,38.
747,35.25,33.5,32.35/
P=PRES
IF(P.LT.1.0) P=1.0
T=TEMP
IF(T.LT.180.) GO TO 12
IF(T.LT.200.) GO TO 4
IF(T.GE.600.0) T=5999.
IF(P.LT.35.3) GO TO 2
IF(P.LT.353.) GO TO 1
N=1
N1=27
GO TO 33
1 N=2
GO TO 33
N1=28
GO TO 33
2 IF(P.LT.4.57) GO TO 3
N=3
N1=29
GO TO 33
3 N=4
N1=30
GO TO 33
4 IF(T.LT.500.) GO TO 8
IF(P.LT.35.3) GO TO 6
IF(P.LT.353.) GO TO 5
N=5
GO TO 33
5 N=6
GO TO 33
6 IF(P.LT.3.53) GO TO 7
N=7
GO TO 33
7 N=8
GO TO 33
8 IF(P.LT.35.3) GO TO 10
IF(P.LT.353.) GO TO 9
N=9
GO TO 33

```

```

23 IF(P.LT.183.7) GO TO 28
  IF(P.LT.448.88) GO TO 24
  N=19
  GO TO 33
24 IF(I.LT.68.4) GO TO 25
  N=28
  GO TO 33
25 IF(P.LT.257.18) GO TO 26
  N=21
  GO TO 33
26 IF(I.LT.63) GO TO 27
  N=22
  GO TO 33
27 N=23
  GO TO 33
28 IF(P.LT.6.716) GO TO 30
  IF(P.LT.48.5) GO TO 29
  N=24
  GO TO 33
29 N=25
  GO TO 33
30 N=26
  GO TO 33
33 IF(I.LE.5088.9M1=N
  FP=(P-BP(N))/DP(N)
  IP=FP
  IF(IP-67.MX(N)) IP=MX(N)
  FP=1.8-F
  FT=(I-BT(N1))/DT(N)
  IT=FT
  FT=1.8-FF
  FF=FT-IT
  I=I*JP(N)+IP*LOC(N1)
  J=I*JP(N)
  PTENTR=FP+FT*S(I)+F*FT*S(I+1)+FP*FF*S(J)+F*FF*S(J+1)
  RETURN
END

SUBROUTINE PTSDATA
COMMON/PTENTROP/S(748)
DATA(S(1),I=327,53)=6.571,8.628,7.888,6.213,5.688,5.141,4.793,9.
1882,7.686,6.811,6.315,5.91,5.598,9.461,8.837,7.279,6.807,6.454,6.17,
29.8,8.42,7.682,7.23,6.897,6.632,10.18,8.773,8.849,7.617,29.7,834
3.18,84,9.187,8.397,7.997,7.749,7.518,4.3,9.048,8.343,7.921,7.617,1
41.35,9.972,9.279,8.869,8.574,12.11,18.74,18.85,9.644,9.355,12.91,1
51.47,18.72,18.35,18.13,12.53,11.34,18.65,10.25,9.96,13.41,12.25,11
6.57,11.17,18.88,14.18,13.81,12.33,11.93,11.64,14.74,13.73,13.12,6
7.12,4.1,32.1,286,1.254,1.224,1.198,1.173,1.881,1.828,1.782,1.742,1
8.78,1.67,2.488,2.395,2.32,2.257,2.284,2.157,3.399,3.896,2.515,2.8
981,2.715,2.645,4.313,4.157,3.659,3.448,3.254,3.168,2.768,2.734)
DATA(I(S1),I=436,543)=2.7,2.672,2.645,3.293,3.215,3.151,3.896,3.06
13,3.914,3.749,3.633,3.544,3.482,4.653,4.368,4.172,4.029,3.912,5.21
24,4.934,4.783,4.519,4.353,5.688,5.374,5.141,4.967,4.793,6.198,5.52
38,4.888,4.283,3.914,4.523,5.983,5.495,5.842,4.655,6.884,5.318,5.89
49,5.536,5.214,7.888,6.65,6.213,5.91,5.688,3.444,3.361,3.311,3.281,
53.212,3.162,3.689,3.953,3.464,3.396,3.341,3.293,4.881,3.793,3.655,
93.562,3.491,3.448,4.621,4.117,3.884,3.749,3.654,3.683,4.957,4.582,
7.18,3.963,3.835,3.759,5.168,4.889,4.586,4.203,4.859,3.914,5.383,5

```

65

```

FUNCTION PTCOND(PRES,TEMP)
DIMENSION PSI(19),TS(19),JPI(19),MX(19),LOC(19),BP(19),DP(19),BT(19)
,DT(19),C(730)
COMMON /DATA/ A( 96),AB(101),AC(114),AD( 97),AE( 97),AF(112),AG(110)
,AM( 3)
EQUIVALENCE( C( 97),AB),( C( 97),AB),( C( 198),AC),( C( 312),AD)
,( C( 409),AE),( C( 506),AF),( C( 618),AG),( C( 732),AM)
,DATA/AA/ .04565, .0628, .04642, .04702, .04764, .04823, .04888, .0523, .05222
, .05324, .05384, .05434, .05494, .05546, .05595, .05616, .05703, .05781, .0
, .05808, .05931, .06, .05671, .05785, .05891, .0599, .06086, .06173, .06258, .0
, .06336, .06403, .06473, .06544, .06616, .06686, .06754, .06826, .06894, .06964, .07034
, .07104, .07174, .07244, .07314, .07384, .07454, .07524, .07594, .07664, .07734, .07804, .07874, .07944, .08014, .08084, .08154, .08224, .08294, .08364, .08434, .08504, .08574, .08644, .08714, .08784, .08854, .08924, .08994, .09064, .09134, .09204, .09274, .09344, .09414, .09484, .09554, .09624, .09694, .09764, .09834, .09904, .09974, .10044, .10114, .10184, .10254, .10324, .10394, .10464, .10534, .10604, .10674, .10744, .10814, .10884, .10954, .11024, .11094, .11164, .11234, .11304, .11374, .11444, .11514, .11584, .11654, .11724, .11794, .11864, .11934, .12004, .12074, .12144, .12214, .12284, .12354, .12424, .12494, .12564, .12634, .12704, .12774, .12844, .12914, .12984, .13054, .13124, .13194, .13264, .13334, .13404, .13474, .13544, .13614, .13684, .13754, .13824, .13894, .13964, .14034, .14104, .14174, .14244, .14314, .14384, .14454, .14524, .14594, .14664, .14734, .14804, .14874, .14944, .15014, .15084, .15154, .15224, .15294, .15364, .15434, .15504, .15574, .15644, .15714, .15784, .15854, .15924, .15994, .16064, .16134, .16204, .16274, .16344, .16414, .16484, .16554, .16624, .16694, .16764, .16834, .16904, .16974, .17044, .17114, .17184, .17254, .17324, .17394, .17464, .17534, .17604, .17674, .17744, .17814, .17884, .17954, .18024, .18094, .18164, .18234, .18304, .18374, .18444, .18514, .18584, .18654, .18724, .18794, .18864, .18934, .19004, .19074, .19144, .19214, .19284, .19354, .19424, .19494, .19564, .19634, .19704, .19774, .19844, .19914, .19984, .20054, .20124, .20194, .20264, .20334, .20404, .20474, .20544, .20614, .20684, .20754, .20824, .20894, .20964, .21034, .21104, .21174, .21244, .21314, .21384, .21454, .21524, .21594, .21664, .21734, .21804, .21874, .21944, .22014, .22084, .22154, .22224, .22294, .22364, .22434, .22504, .22574, .22644, .22714, .22784, .22854, .22924, .22994, .23064, .23134, .23204, .23274, .23344, .23414, .23484, .23554, .23624, .23694, .23764, .23834, .23904, .23974, .24044, .24114, .24184, .24254, .24324, .24394, .24464, .24534, .24604, .24674, .24744, .24814, .24884, .24954, .25024, .25094, .25164, .25234, .25304, .25374, .25444, .25514, .25584, .25654, .25724, .25794, .25864, .25934, .26004, .26074, .26144, .26214, .26284, .26354, .26424, .26494, .26564, .26634, .26704, .26774, .26844, .26914, .26984, .27054, .27124, .27194, .27264, .27334, .27404, .27474, .27544, .27614, .27684, .27754, .27824, .27894, .27964, .28034, .28104, .28174, .28244, .28314, .28384, .28454, .28524, .28594, .28664, .28734, .28804, .28874, .28944, .29014, .29084, .29154, .29224, .29294, .29364, .29434, .29504, .29574, .29644, .29714, .29784, .29854, .29924, .29994, .30064, .30134, .30204, .30274, .30344, .30414, .30484, .30554, .30624, .30694, .30764, .30834, .30904, .30974, .31044, .31114, .31184, .31254, .31324, .31394, .31464, .31534, .31604, .31674, .31744, .31814, .31884, .31954, .32024, .32094, .32164, .32234, .32304, .32374, .32444, .32514, .32584, .32654, .32724, .32794, .32864, .32934, .33004, .33074, .33144, .33214, .33284, .33354, .33424, .33494, .33564, .33634, .33704, .33774, .33844, .33914, .33984, .34054, .34124, .34194, .34264, .34334, .34404, .34474, .34544, .34614, .34684, .34754, .34824, .34894, .34964, .35034, .35104, .35174, .35244, .35314, .35384, .35454, .35524, .35594, .35664, .35734, .35804, .35874, .35944, .36014, .36084, .36154, .36224, .36294, .36364, .36434, .36504, .36574, .36644, .36714, .36784, .36854, .36924, .36994, .37064, .37134, .37204, .37274, .37344, .37414, .37484, .37554, .37624, .37694, .37764, .37834, .37904, .37974, .38044, .38114, .38184, .38254, .38324, .38394, .38464, .38534, .38604, .38674, .38744, .38814, .38884, .38954, .39024, .39094, .39164, .39234, .39304, .39374, .39444, .39514, .39584, .39654, .39724, .39794, .39864, .39934, .39994, .40064, .40134, .40204, .40274, .40344, .40414, .40484, .40554, .40624, .40694, .40764, .40834, .40904, .40974, .41044, .41114, .41184, .41254, .41324, .41394, .41464, .41534, .41604, .41674, .41744, .41814, .41884, .41954, .42024, .42094, .42164, .42234, .42304, .42374, .42444, .42514, .42584, .42654, .42724, .42794, .42864, .42934, .43004, .43074, .43144,
```



```

DATA(C(1),1=95,193)=.07464,.07751,.08892,.06025,.07318,.07739,.08
1134,.08456,.08636,.07482,.07575,.08292,.0867,.06748,.0735,.07933,
20836,.08778,.06556,.07279,.07849,.08337,.08773,.06284,.07894,.077
389,.08227,.08684,.06795,.07877,.087359,.08825,.08729,.08892,.088
43,.08995,.08523,.09383,.1013,.08735,.09689,.1825,.08789,.09818,.10
57,.08684,.0766,.1069,.08538,.09667,.1062,.08361,.09529,.105,.0816
74,.08366,.1035,.07965,.0919,.1049,.07765,.09011,.1002,.0752,.0883
74,.0885,.07389,.08663,.09681,.0722,.085,.09517,.08717,.0878,.088
88,.0889,.0899,.08175,.08134,.088,.08173,.08235,.08134,.08142,
9816,.08195,.0844,.08486,.08539,.08603,.08603,.08787,.08689,.08728,
DATA(C(1),1=194,304)=.07711,.08489,.084871,.08129,.08366,.0871,
12888,.08247,.08288,.082132,.1355,.0765,.82,.081997,.1266,.08583,
297,.2737,.1956,.1145,.08103,.355,.2739,.1924,.106,.4435,.3594,.2766
3,.1922,.5389,.4519,.3672,.2827,.6412,.5589,.464,.3784,.7503,.6568,
4,.5673,.0881,.186,.1823,.1688,.1471,.1327,.117,.116,.0897,.08738,0
5,.1833,.08261,.08923,.03742,.1647,.5827,.08644,.1235,.1575,.1935
6,.8205,.3245,.6437,.9728,.1317,.1664,.02782,.2195,.4653,.7696,
73,.1482,.051,.1085,.3222,.5864,.0749,.1768,.08175,.3979,.6745
8,.9617,.082,.168,.1714,.468,.7537,.0676,.171,.4237,.4227,.088
91345,.1942,.3248,.4415,.5429,.8...1993,.2479,.3348,.458,.5758,.693)
P=PRES
IF(P.LT.1.0) P=1.0
Y=TEMP
IF(T.GE.6008.1)=5999.9999
DIV=1.0
IF(T.GE.108.0) GO TO 15
IF(T.LT.7217)=T2
IF(P.GE.780.0) GO TO 4
IF(P.GE.80.0) GO TO 3
IF(P.LT.187.506) GO TO 7
IF(P.LT.56.0) GO TO 12
IF(P.GT.408.0) GO TO 2
IF(T.GE.68.8) GO TO 5
IF(T.GE.TM) GO TO 1
M=7
DIV=(P-187.506)*.083+TM-T
GO TO 33
1 M=8
DIV=(P-187.506)*.083+T-TM
GO TO 33
2 M=9
GO TO 33
3 M=11
GO TO 33
4 IF(P.GE.2508.0) GO TO 6
IF(T.GE.68.8) GO TO 5
M=2
GO TO 33
5 M=10
GO TO 33
6 M=3
GO TO 33
7 00 8 I=2,19
IF(P-PS(I)) 10,9,6
8 CONTINUE
9 TM=TS(I)
GO TO 11

```

```

3.464,.3784,.7503,.6568,.5673,.4801,.1186,.1823,.1688,.1471,.1327,.1
417,.116,.0897,.06738,.0...1033,.02061,.0...0923,.03742,.1647,.5027,
5.0564,1.215,1.575,1.935,0.205,0.3245,.6437,9728,1.317,1.664,.02782
6,.2195,.4653,.7696,1.083,1.402,.051,.1085,.3222,.5864,.0749,1.178
7,0.0...175,.3979,.6745,.9617,.002,1.0...1714,.468,.7537,.0676,,
817,.4237,.002,0.0...1345,.1942,.3248,.4415,.5429,0...1993,.2479
9,.3348,.458,.5758,.693,.8266,.9146,.9814,.4838,.603,.7319,.3369/
DATAAD/.3941,.4481,.5344,.6445,.7709,.4104,.4577,.5192,.5976,.6964
1,.0146,.4074,.5352,.5954,.6698,.7616,.8713,.05874,.06089,.06134,.0
26249,.06357,.06459,.06556,.06586,.05724,.05872,.06007,.06134,.0624
37,.06355,.05203,.05394,.05574,.05734,.05878,.06011,.06134,.0492,.0
45102,.05267,.05431,.0561,.05753,.05892,.04593,.0461,.05003,.05176,
505332,.05676,.05634,.04202,.04488,.04717,.04916,.05093,.05253,.053
699,.0379,.0445,.0462,.04647,.04845,.05021,.05182,.0349,.03832,.04
7131,.04383,.046,.04792,.04965,.03308,.03602,.03886,.04143,.04371,,
804374,.04758,.06284,.07094,.07709,.08227,.08684,.0947,.0655,.07269
9,.07856,.08361,.0877,.05964,.06774,.07422,.07965,.04222,.0551/
DATAAE/.08309,.07,.07572,.03963,.05101,.05952,.06634,.0722,.01936,
1.023,.02998,.04018,.04758,.02049,.024,.0294,.03728,.04452,.02161,
202484,.02949,.03569,.04217,.02273,.02573,.02979,.03494,.04058,.023
385,.02667,.03028,.03472,.03966,.02386,.0373,.05312,.06377,.0722,.0
47907,.085,.09031,.09517,.02868,.0382,.0496,.05988,.06779,.07458,.0
5805,.08576,.09056,.03366,.04106,.04988,.0584,.06584,.07229,.07796,
6.08305,.0877,.03977,.04627,.05363,.06095,.06769,.07374,.07918,.084
713,.08069,.04614,.052,.05841,.06483,.07091,.07653,.08169,.08644,.0
89085,.04614,.05841,.07091,.08169,.09085,.07156,.08113,.08993,.0979
98,.1054,.08752,.09393,.09962,.1049,.11,.09764,.1017,.1053,.1087/
DATAAF/.112,.1067,.1091,.1111,.1131,.1151,.1067,.1119,.1662,.1662,
1.2210,.2210,.2777,.2777,.3362,.3354,.41,.3934,.41,.405,.4028,.4015
2,.4006,.4594,.4467,.441,.4376,.4353,.539,.5096,.4966,.4888,.4835,
36718,.6102,.5829,.5666,.5555,.8907,.772,.7193,.6878,.6663,1.239,1
4026,.9316,.8749,.8362,.769,.1412,1.252,1.156,.1092,535,1.971,1.7
516,1.563,1.458,.583,2.744,2.361,2.129,.1974,929,3.762,3.217,2.08
65,2.654,6.528,5.024,4.297,3.845,3.53,6.24,6.483,5.58,5.005,4.598,9
7.796,8.013,6.995,6.318,5.825,10.83,9.407,8.405,7.686,7.141,11,10
837,9.587,8.935,8.402,10.22,10.65,10.31,9.865,9.44,.4028,3984,.396
98,.3961,.441,.4296,.4256,.4238,.4967,.4703,.461,.4569,.5831,.5278/
DATAAG/.5083,.4996,.7197,.6129,.5751,.5583,.9325,.7399,.6716,.6412
1,1.254,.0269,.0108,.7592,1.721,1.196,1.008,.9249,2.371,1.569,1.282
2,1.153,3.238,2.071,1.649,1.459,4.339,2.721,2.127,1.857,5.664,3.531
3,2.729,2.362,7.155,4.495,3.463,2.981,8.69,5.592,4.324,3.717,10.05,
46.751,5.285,4.555,10.99,7.887,6.31,5.475,.3974,.3957,.3949,.4875,
54.731,4.663,.6955,.6232,.5889,1.217,.9678,.8495,2.344,1.695,1.385,4
6.337,3.001,2.357,.094,.936,3.833,.396,.3943,.3938,.4754,.4602,.456
74,.6346,.5585,.5392,1.008,.7441,.6772,1.804,1.106,.9271,3.249,1.75
8,1.36,5.438,2.763,2.042,.394,.3935,.3934,.4578,.4536,.4525,.5462,,
95252,.5196,.7016,.6285,.609,.9925,.7965,.744,1.504,1.072,.9551/
DATAAH/2.315,1.497,1.274/
DATA JP/7,5,3,6,4,3,6,6,7,5,5,9,5,2,5,4,3,3,3/
DATA MX/5,3,1,4,2,1,4,4,5,3,3,7,3,0,3,2,1,1,1/
DATA LOC/1,78,123,168,204,236,251,281,329,392,417,442,487,512,524,
1 604,668,689,710/
DATA BP/52,700,,2500,,0,,100,,142.5,187.5,187.5,400,,700,,0,,0,,
1 0,,0,,1,,0,,0,,100,,0,/
DATA DP/108,,450,,1250,,20,,30,,22.5,42.5,42.5,450,,175,,1625,,
1 1250,,3000,,1,10,,40,,300,,1500,/
DATA BT/26,,20,,30,,25,,52,,56,,56,,59,,56,,60,,80,,100,,180,,500,
1 3000,,3000,,3000,,3000,,3000,/

```

```

10 TM=TS(I-1)+(TS(I)-TS(I-1))*(P-PS(I-1))/(PS(I)-PS(I-1))
11 IF(T.GE.TM) GO TO 13
  IF(T.LT.56.0) GO TO 12
  N=6
  DIV=(187.506-P)*.083+TM-T
  GO TO 33
12 N=1
  GO TO 33
13 IF(P.GE.100.0) GO TO 14
  N=4
  GO TO 33
14 N=5
  DIV=(187.506-P)*.083+T-TM
  GO TO 33
15 IF(T.GE.300.0) GO TO 18
  IF(T.GE.500.0) GO TO 17
  IF(T.GE.100.0) GO TO 16
  N=12
  GO TO 33
16 N=13
  GO TO 33
17 N=14
  GO TO 33
18 IF(P.GE.30.0) GO TO 20
  IF(P.GE.5.0) GO TO 19
  N=15
  GO TO 33
19 N=16
  GO TO 33
20 IF(P.GE.500.0) GO TO 22
  IF(P.GE.100.0) GO TO 21
  N=17
  GO TO 33
21 N=18
  GO TO 33
22 N=19
  GO TO 33
23 FP=(P-8P(N))/DP(N)
  IP=FP
  IF(IP.GT.MX(N)) IP=MX(N)
  F=FP-IP
  FP=1.0-F
  FT=(T-BT(N))/DT(N)
  IT=FT
  FF=FT-IT
  FI=1.0-FF
  I=IT*JP(N)+IP+LOC(N)
  J=I*JP(N)
  PTCMD=(FP*FT+C(I)-F*FT+C(I+1)+FP*FF+C(J)+F*FF+C(J+1))/DIV
  RETURN
END

SUBROUTINE DATAONO
COMMON/LAMBDA/C(730)
DATA(C(1),I=305,400)=2666.,3146.,3051.,4038.,603.,7319.,3369.,38
141.,4481.,5344.,6445.,7709.,4104.,4577.,5192.,5976.,6984.,8146.,48
27.,5352.,5924.,6690.,7616.,8713.,05074.,06089.,06134.,06249.,0635
37.,06459.,06556.,06558.,05724.,05072.,06087.,06131.,06247.,06355.,
405203.,05394.,05574.,05734.,05070.,06011.,06134.,06492.,05102.,0526

```

```

DATA DT/3.,4.,5.,11.,4.,1.,3.,3.,10.,5.,20.,80.,500.,200.,200.,
1 500.,500.,500./
DATA PS/1.022,2.0,4.0,10.0,14.0,25.0,43.0,69.0,99.0,120.0,151.0,
1165.0,176.0,102.0,185.0,186.5,187.25,187.46875,187.506/
DATA TS/24.445,27.07,29.81,33.07,36.18,39.96,44.12,48.33,51.97,
154.79,56.72,57.80,58.57,59.18,59.29,59.34,59.353,59.356/
P=PRES
IF(P.LT.1.0) P=1.0
T=TEMP
IF(T.GE.6000.)T=5999.9999
DIV=1.0
IF(T.GE.100.0) GO TO 15
TZ=24.04+.00317*P
IF(T.LT.TZ)T=TZ
IF(P.GE.700.0) GO TO 4
IF(T.GE.60.0) GO TO 3
IF(P.LT.187.506) GO TO 7
IF(T.LT.56.0) GO TO 12
IF(P.GT.400.0) GO TO 2
TM=(-0.000523467*P+0.08690291)*P+44.882441
IF(T.GE.TM) GO TO 1
N=7
DIV=(P-187.506)*.083+TM-T
GO TO 33
1 N=8
  DIV=(P-187.506)*.083+T-TM
  GO TO 33
2 N=9
  GO TO 33
3 N=11
  GO TO 33
4 IF(P.GE.2500.0) GO TO 6
  IF(T.GE.60.0) GO TO 5
  N=2
  GO TO 33
5 N=10
  GO TO 33
6 N=3
  GO TO 33
7 DO A I=2,19
  IF(P-PS(I)) 10,9,8
8 CONTINUE
9 TM=TS(I)
  GO TO 11
10 TM=TS(I-1)+(TS(I)-TS(I-1))*(P-PS(I-1))/(PS(I)-PS(I-1))
11 IF(T.GE.TM) GO TO 13
  IF(T.LT.56.0) GO TO 12
  N=6
  DIV=(187.506-P)*.083+TM-T
  GO TO 33
12 N=1
  GO TO 33
13 IF(P.GE.100.0) GO TO 14
  N=4
  GO TO 33
14 N=5
  DIV=(187.506-P)*.083+T-TM
  GO TO 33

```



69

69

```

720E-11,2.532E-11,2.625E-11,2.744E-11,2.88E-11,3.029E-11,5.444E-11,
86.191E-11,6.001E-11,7.543E-11,4.154E-11,4.921E-11,5.559E-11,6.091E
9-11,3.164E-11,3.988E-11,4.613E-11,5.159E-11,2.57E-11,3.308E-11/
DATAAP/3.919E-11,4.432E-11,2.234E-11,2.867E-11,3.427E-11,3.911E-11
1.2.131E-11,2.623E-11,3.099E-11,3.553E-11,2.113E-11,2.509E-11,2.9E-
211,3.20E-11,2.141E-11,2.463E-11,2.792E-11,3.134E-11,2.192E-11,2.45
37E-11,2.739E-11,3.019E-11,1.557E-11,1.635E-11,1.739E-11,1.901E-11,
42.131E-11,1.667E-11,1.738E-11,1.825E-11,1.948E-11,2.113E-11,1.774E
5-11,1.839E-11,1.946E-11,2.014E-11,2.141E-11,1.877E-11,1.941E-11,2.
6006E-11,2.099E-11,2.192E-11,3.35E-11,3.675E-11,3.938E-11,4.154E-11,2.076E-
74.645E-11,2.868E-11,3.35E-11,3.716E-11,3.716E-11,1.748E-11,2.262E-11,2.7
811,2.766E-11,3.178E-11,3.403E-11,3.716E-11,3.938E-11,4.154E-11,2.076E-
922E-11,3.068E-11,3.329E-11,1.649E-11,2.07E-11,2.377E-11,2.712E-11/
DATAAG/3.5-11,1.64E-11,1.897E-11,2.156E-11,2.448E-11,2.72E-11,1.6
112E-11,1.79E-11,2.025E-11,2.27E-11,2.517E-11,1.625E-11,1.766E-11,1
2.95E-11,2.154E-11,2.37E-11,1.649E-11,1.766E-11,1.913E-11,2.086E-11
3.2.268E-11,1.676E-11,1.774E-11,1.896E-11,2.044E-11,2.202E-11,1.707
4E-11,1.79E-11,1.892E-11,2.019E-11,2.157E-11,1.739E-11,1.82E-11,1.9
501E-11,2.016E-11,2.131E-11,2.484E-11,2.618E-11,2.97E-11,3.086E-11,
63.1-1E-11,3.261E-11,3.335E-11,3.401E-11,3.461E-11,3.52E-11,3.573E-
711,1.441E-11,1.56E-11,1.612E-11,2.297E-11,2.59E-11,2.757E-11,2.885
8E-11,2.987E-11,3.076E-11,3.154E-11,3.225E-11,1.368E-11,1.429E-11,1
9.511E-11,1.626E-11,1.791E-11,2.015E-11,2.259E-11,2.458E-11/
DATAAM/2.611E-11,2.728E-11,2.831E-11,1.35E-11,1.394E-11,1.438E-11,
11.508E-11,1.578E-11,1.689E-11,1.8E-11,1.949E-11,2.099E-11,2.248E-11
21,2.394E-11,1.35E-11,1.438E-11,1.578E-11,1.689E-11,1.8E-11,1.949E-11,2.099E-11,2.248E-11
311,3.74E-11,1.442E-11,1.503E-11,1.578E-11,1.634E-11,1.689E-11,1.8E-11,1.949E-11,2.099E-11,2.248E-11
453E-11,1.404E-11,1.471E-11,1.562E-11,1.603E-11,1.634E-11,1.689E-11,1.8E-11,1.949E-11,2.099E-11,2.248E-11
5.1.405E-11,1.459E-11,1.526E-11,1.615E-11,1.615E-11,1.725E-11,1.77E-11,1.414
6E-11,1.450E-11,1.512E-11,1.582E-11,1.664E-11,1.664E-11,1.377E-11,1.484E-11,1
7.664E-11,1.393E-11,1.486E-11,1.635E-11,1.409E-11,1.409E-11,1.489E-11,1.61E-11
81,1.427E-11,1.499E-11,1.604E-11,1.445E-11,1.523E-11,1.604E-11,1.563E-11/
DATAAL/1.606E-11,1.658E-11,1.662E-11,1.697E-11,1.736E-11/
P=PRES
IF(P.LT.1.0) P=1.0
T=TEMP
IF(T.LT.180.0) GO TO 7
IF(T.GE.500.0) GO TO 1
N=1
GO TO 30
1 IF(T.GE.3000.0) GO TO 4
IF(T.GE.2000.0) GO TO 2
N=2
GO TO 30
2 IF(P.GT.5.0) GO TO 3
N=3
GO TO 30
3 N=4
GO TO 30
4 IF(T.GE.6000.0) T=5999.99999
IF(P.GE.5.0) GO TO 5
N=5
GO TO 30
5 IF(P.GE.30.0) GO TO 6
N=6
GO TO 30
6 N=7

```

```

M=6
GO TO 30
6 M=7
GO TO 30
7 IF(P.LT.149.8) GO TO 12
IF(T.GE. 83.8) GO TO 10
IF(T.GE.41.4) GO TO 9
M=8
8 T=24.94+8.88317*P
IF(T.LT.72) T=72
GO TO 30
9 M=9
GO TO 30
10 IF(T.GE.117.8) GO TO 11
M=10
GO TO 30
11 M=11
GO TO 30
12 IF(T.GE.59.4) GO TO 17
M=12
IF(P.GE.197.6385) GO TO 8
DO 13 I=2,28
IF(P-PS(I)) 15,14,13
13 CONTINUE
14 TL=TS(I)
GO TO 16
15 TL=TS(I-1)+(TS(I)-TS(I-1))*(P-PS(I-1))/(PS(I)-PS(I-1))
16 IF(T.E.L) GO TO 8
M=13
GO TO 30
17 IF(T.LT.126.8) GO TO 18
M=14
GO TO 30
18 IF(P.LT.587.84) GO TO 19
M=15
GO TO 30
19 IF(T.LT.99.8) GO TO 20
M=16
GO TO 30
20 IF(P.GE.198.8) GO TO 21
M=13
GO TO 30
21 IF(P.LT.293.92) GO TO 22
M=17
GO TO 30
22 IF(T.GE.72.8) GO TO 24
IF(T.GE.64.8) GO TO 23
M=18
GO TO 30
23 M=19
GO TO 30
24 IF(T.GE.81.8) GO TO 25
M=20
GO TO 30
25 M=21
30 PP=(P-8P(N))/DP(N)
IP=PP
IF(IP.GT.MX(N)) IP=MX(N)

```



```

FUNCTION PTSUM(PRES,TEMP)
DIMENSION LOC(23),JPI(19),MX(19),BP(19),DP(19),BT(23),DT(19),PS(20)
A=1.5708,TL(18)
COMMON/SPEED/V(522)
DATA (V(I),I=1,103)=5248.,5250.,5264.,5403.,5848.,6329.,6930.,6940
1,7044.,7537.,8229.,8229.,8732.,8736.,9301.,9305.,9313.,9386
2,9740.,10370.,10228.,10250.,10328.,10648.,10710.,10950.,11060.,11
3,1160.,11460.,11250.,11490.,11720.,11980.,12210.,12160.,12100.,12280
4,12540.,12880.,12335.,13067.,4414.,2590.,3466.,4524.,3033.,3865.,47
5,4882.,3445.,4228.,5939.,3824.,4560.,5327.,4169.,4061.,5580.,4408.,51
6,5019.,4783.,5040.,6040.,2103.,1252.,2559.,3409.,4133.,4709.,51
7,5800.,2375.,2468.,2663.,3240.,3842.,4374.,4644.,2532.,2640.,2795.,32
8,3336.,3726.,4189.,4613.,2681.,2788.,2927.,3284.,3688.,4088.,4471.,28
9,4347.,2958.,3867.,3904.,3741.,4407.,4416.,4935.,5128.,5390.,5670.,
DATA (BT,24.,8467.,2717.,29310.,31299.,33176.,34962.,36672.,38317.,
39339.,38414.,41456)
DATA (PS,1.022,2.,4.,8.,16.,25.,43.,69.,99.,128.,151.,165.,176.,182
1,195.,186.,5.,107.,25.,107.,46875.,107.,506.,190.,)
DATA (TS,24.,845.,27.07,29.81,33.87,36.13,39.96,44.12,48.33,51.97,54.
79,56.72,60.58,57.58,99.59,18.59,39.34,59.353,59.356,59.517)
DATA (JP,5.5,5.5,3.7,6.6,11.3,4.4,6.7,4.6,12.7,4.)
DATA (MX,0.0,0.0,1.3,2.0,0.9,1.2,2.4,5.2,4.0,1.0,1.0)
DATA (BP,1000.,100.,10.,0.,3000.,1000.,0,2000.,1000.,0,600.,0,300.,,
300.,0.,10.,108.,198.,0,1000.,)
DATA (DP,4000.,900.,90.,10.,4000.,1000.,1000.,500.,100.,200.,200.,,
100.,50.,50.,60.,40.,10.,500.,500.,)
DATA (BT=800.,800.,800.,800.,800.,240.,120.,20.,20.,80.,25.,50.,63.,,
668.,28.,58.,60.,120.,80.,5080.,5000.,5000.,5000.,)
DATA (DT=600.,600.,600.,600.,600.,30.,20.,10.,10.,5.,5.,2.,4.,5.,
2.,1.,30.,10.,)
DATA (LOC=3.,2.,1.,41.,67.,102.,100.,136.,191.,212.,236.,264.,308.,328.,366.,400
1,65.,339.,511.,510.,509.,508)
P=PRES
T=TEMP
IF (P.LT.1.0) P=1.0
IF (T.LT.120.) GO TO 6
IF (T.LT.800.) GO TO 4
IF (T.LT.5000.) T=5999.99999
IF (P.LT.1800.) GO TO 2
IF (P.LT.10000.) GO TO 1
IF (P.LT.10000.) GO TO 1

```

```

IT=IT
FF=FF-IT
FT=1.0-FF
I=IT*JP(N)+IP+LOC(N)
J=I*JP(M)
PTWISG=FP*FT*V(I)+F*FT*V(I+1)+FP*FF*V(J)+F*FF*V(J+1)
RETURN
END

FUNCTION PTSOUN(PRES,TEMP)
DIMENSION LOC(23),JP(19),WK(19),BP(19),DP(19),BT(23),DT(19),PS(20)
1,TS(20),TL(10),V(522)
DIMENSION AA(105),AB(108),AC(112),AE( 89)
EQUIVALENCE ( V,AA), ( V( 106),AB), ( V( 214),AC), ( V( 322),AD)
      ( V( 436),AE)
1 DATA TL/24.846,27.175,29.310,31.299,33.176,34.962,36.672,38.317,
136.90,44.456/
DATA PS/1.022,2.448,3.881,5.314,6.747,8.180,9.613,11.046,12.479,
1.185,186.5,187.25,187.99,188.73,189.47,190.21,190.95,191.69,192.43,
193.17,193.91,194.65,195.39,196.13,196.87,197.61,198.35,199.09,199.83,
179.56,72.57,80.58,57.58,99.59,16.59,29.59,34.59,35.59,36.59,37.59,38.59,39.59,40.59,41.59,42.59,43.59,44.59,45.59,46.59,47.59,48.59,49.59,50.59,51.59,52.59,53.59,54.59,55.59,56.59,57.59,58.59,59.59,60.59,61.59,62.59,63.59,64.59,65.59,66.59,67.59,68.59,69.59,70.59,71.59,72.59,73.59,74.59,75.59,76.59,77.59,78.59,79.59,80.59,81.59,82.59,83.59,84.59,85.59,86.59,87.59,88.59,89.59,90.59,91.59,92.59,93.59,94.59,95.59,96.59,97.59,98.59,99.59,100.59,101.59,102.59,103.59,104.59,105.59,106.59,107.59,108.59,109.59,110.59,111.59,112.59,113.59,114.59,115.59,116.59,117.59,118.59,119.59,120.59,121.59,122.59,123.59,124.59,125.59,126.59,127.59,128.59,129.59,130.59,131.59,132.59,133.59,134.59,135.59,136.59,137.59,138.59,139.59,140.59,141.59,142.59,143.59,144.59,145.59,146.59,147.59,148.59,149.59,150.59,151.59,152.59,153.59,154.59,155.59,156.59,157.59,158.59,159.59,160.59,161.59,162.59,163.59,164.59,165.59,166.59,167.59,168.59,169.59,170.59,171.59,172.59,173.59,174.59,175.59,176.59,177.59,178.59,179.59,180.59,181.59,182.59,183.59,184.59,185.59,186.59,187.59,188.59,189.59,190.59,191.59,192.59,193.59,194.59,195.59,196.59,197.59,198.59,199.59,200.59,201.59,202.59,203.59,204.59,205.59,206.59,207.59,208.59,209.59,210.59,211.59,212.59,213.59,214.59,215.59,216.59,217.59,218.59,219.59,220.59,221.59,222.59,223.59,224.59,225.59,226.59,227.59,228.59,229.59,230.59,231.59,232.59,233.59,234.59,235.59,236.59,237.59,238.59,239.59,240.59,241.59,242.59,243.59,244.59,245.59,246.59,247.59,248.59,249.59,250.59,251.59,252.59,253.59,254.59,255.59,256.59,257.59,258.59,259.59,260.59,261.59,262.59,263.59,264.59,265.59,266.59,267.59,268.59,269.59,270.59,271.59,272.59,273.59,274.59,275.59,276.59,277.59,278.59,279.59,280.59,281.59,282.59,283.59,284.59,285.59,286.59,287.59,288.59,289.59,290.59,291.59,292.59,293.59,294.59,295.59,296.59,297.59,298.59,299.59,300.59,301.59,302.59,303.59,304.59,305.59,306.59,307.59,308.59,309.59,310.59,311.59,312.59,313.59,314.59,315.59,316.59,317.59,318.59,319.59,320.59,321.59,322.59,323.59,324.59,325.59,326.59,327.59,328.59,329.59,330.59,331.59,332.59,333.59,334.59,335.59,336.59,337.59,338.59,339.59,340.59,341.59,342.59,343.59,344.59,345.59,346.59,347.59,348.59,349.59,350.59,351.59,352.59,353.59,354.59,355.59,356.59,357.59,358.59,359.59,360.59,361.59,362.59,363.59,364.59,365.59,366.59,367.59,368.59,369.59,370.59,371.59,372.59,373.59,374.59,375.59,376.59,377.59,378.59,379.59,380.59,381.59,382.59,383.59,384.59,385.59,386.59,387.59,388.59,389.59,390.59,391.59,392.59,393.59,394.59,395.59,396.59,397.59,398.59,399.59,400.59,401.59,402.59,403.59,404.59,405.59,406.59,407.59,408.59,409.59,410.59,411.59,412.59,413.59,414.59,415.59,416.59,417.59,418.59,419.59,420.59,421.59,422.59,423.59,424.59,425.59,426.59,427.59,428.59,429.59,430.59,431.59,432.59,433.59,434.59,435.59,436.59,437.59,438.59,439.59,440.59,441.59,442.59,443.59,444.59,445.59,446.59,447.59,448.59,449.59,450.59,451.59,452.59,453.59,454.59,455.59,456.59,457.59,458.59,459.59,460.59,461.59,462.59,463.59,464.59,465.59,466.59,467.59,468.59,469.59,470.59,471.59,472.59,473.59,474.59,475.59,476.59,477.59,478.59,479.59,480.59,481.59,482.59,483.59,484.59,485.59,486.59,487.59,488.59,489.59,490.59,491.59,492.59,493.59,494.59,495.59,496.59,497.59,498.59,499.59,500.59,501.59,502.59,503.59,504.59,505.59,506.59,507.59,508.59,509.59,510.59,511.59,512.59,513.59,514.59,515.59,516.59,517.59,518.59,519.59,520.59,521.59,522.59,523.59,524.59,525.59,526.59,527.59,528.59,529.59,530.59,531.59,532.59,533.59,534.59,535.59,536.59,537.59,538.59,539.59,540.59,541.59,542.59,543.59,544.59,545.59,546.59,547.59,548.59,549
```

```

M1=28
GO TO 33
1 M1=21
GO TO 33
2 IF(P.LT.10.)GO TO 3
M1=22
GO TO 33
3 M1=23
GO TO 33
4 IF(T.LT.240.) GO TO 5
M1=25
GO TO 33
5 M1=26
IF(P.LT.1000.) N=18
GO TO 33
6 IF(P.LT.1000.)GO TO 8
M1=27
GO TO 33
7 M1=28
GO TO 33
8 IF(T.LT.100.) GO TO 9
M1=29
GO TO 33
9 IF(P.LT.600.) GO TO 10
M1=30
GO TO 33
10 IF(P.LT.300.) GO TO 12
IF(T.LT.50.) GO TO 11
M1=32
IF(P.LT.550.)AND.(T.GE.63.)AND.(T.LE.73.) N=13
GO TO 33
11 M1=11
GO TO 33
12 IF(T.LT.60.) GO TO 13
M1=14
GO TO 33
13 IF(T.LT.60.) GO TO 15
IF(P.LT.190.) GO TO 14
M1=17
GO TO 33
14 M1=19
GO TO 33
15 M1=15
GO TO 33
16 CONTINUE
IF(P.LT.150.) GO TO 17
GO TO 18
17 TM=TS(I-1)+(TS(I)-TS(I-1))/(PS(I)-PS(I-1))
IF(T.GT.TM) GO TO 33
18 IF(T.LT.50.) GO TO 19
M1=16
GO TO 33
19 M1=11

```

```

7.2211..2224..2236..2252..2313..2375..2436..2498..2559..4579..4693.
8.4798..4251..4405..4544..3885..4080..4252..3419..3685..3905..2847.
9.3225..3512..2306..2174..3125..2002..2414..2783..4163..4305..
DATAAC/4446..4580..3882..4097..4268..4415..3639..3875..4077..4251.
1.3372..3651..3880..4068..3009..3377..3658..3885..2470..3019..3391.
2.3652..3205..3391..3529..3652..2839..3073..3260..3419..2337..2692.
3.2943..3133..3699..2297..2598..2847..1536..1742..2204..2576..1656.
4.1757..2016..2306..1741..1793..1937..2154..1954..2205..2455..2596.
5.2736..2849..1680..2008..2249..2427..2593..2730..1542..1812..2071.
6.2279..2451..2610..1544..1692..1910..2132..2315..2491..1586..1656.
7.1816..2010..2192..2371..1608..1679..1751..1921..2091..2252..1671.
8.1632..1592..1553..1518..1503..1543..1720..1687..1656..1627..1603.
9.1595..1586..1766..1739..1714..1692..1676..1669..1673..1812..
DATAAD/1790..1765..1755..1741..1741..1741..1741..1016..677..2957..3641.
1117..828..2701..3392..1215..993..42578..3173..1304..1121..0..0..13
285..1230..1039..0..1461..1351..1180..895..1532..1450..1342..1166..
31599..1538..1468..1392..1663..1616..1569..1525..2745..2854..2964..
43056..3131..3205..2498..2652..2783..2892..2992..3059..2195..2385..
52560..2700..2820..2912..1800..2040..2285..2475..2625..2739..0..134
62..1880..2197..2400..2538..0..523..1301..1804..2129..2337..1249..1
7302..1669..1804..1885..1967..2048..2129..2181..2233..2285..2337..1
8310..1285..1247..1427..1634..1789..1886..1965..2038..2103..2161..2
9209..1357..1337..1319..1302..1347..1509..1660..1786..1875..1953..
DATAAE/2021..2081..1392..1380..1369..1358..1349..1369..1468..1587.
1.1697..1789..1875..1954..1420..1411..1402..1394..1389..1386..1400.
2.1458..1540..1634..1724..1817..1450..1442..1435..1428..1422..1418.
3.1420..1435..1468..1532..1603..1680..1476..1468..1462..1457..1452.
4.1448..1448..1454..1469..1485..1498..1611..1501..1494..1488..1485.
5.1482..1479..1478..1479..1485..1498..1611..1501..1494..1488..1485.
6.1512..1509..1506..1503..1511..1519..1527..1535..1543..12160..1210
70..12280..12540..12880..13260..12930..12900..13120..13480..14050..
813900..13610..13700..14050..
PPRES
IF(P.LT.1.0) P=1.0
T=TEMP
IF(T.LT.120.) GO TO 6
IF(T.LT.800.) GO TO 4
IF(T.GE.6000.0) T=5999.99999
IF(P.LT.100.) GO TO 2
IF(P.LT.1000.) GO TO 1
N=1
M1=20
GO TO 33
1 N=21
M1=21
GO TO 33
2 IF(P.LT.10.)GO TO 3
N=3
M1=22
GO TO 33
3 N=4
M1=23
GO TO 33
4 IF(T.LT.240.) GO TO 5
N=5
GO TO 33
5 N=6
IF(P.LT.1000.) N=18

```





[illegible]

```

FI=IT
FF=FI-FI
FT=1.0-FF
I=IT*JP(N)+IP+LOC(N1)
J=I+JP(N)
PISOUN=IP*FT*V(I)+F*FT*V(I+1)+F*FF*V(J)+F*FF*V(J+1)
RETURN
END

```

```

FUNCTION PTCP(PRES,TEMP)
PTCP=PTHEAT(PRES,TEMP,1)
RETURN
END
FUNCTION PTCV(PRES,TEMP)
PTCV=PTHEAT(PRES,TEMP,2)
RETURN
END
FUNCTION PTGAMM(PRES,TEMP)
PTGAMH=PTHEAT(PRES,TEMP,3)
RETURN
END
FUNCTION PTHEAT(PRES,TEMP,KTRANS)
COMMON/SPEAT/CP(82),CV(823)
DIMENSION LOC(23),JP(19),MX(19),DP(19),BP(19),8P(19),8T(23),DT(19),PS(12)
ATS(12),TL(10)
DATA PS/1.022,2.,4.,8.,16.,25.,43.,69.,99.,126.,151.,160./
DATA TS/24.845,27.07,29.81,33.07,36.18,39.96,44.12,48.33,51.97,
54.79,58.72,57.46/
DATA LOC/1,50,71,113,133,141,170,165,228,264,348,372,426,492,528,
604,684,626,638,734,654,682,694,718/
DATA JP/7,3,6,5,2,4,9,9,4,7,4,9,6,7,7,2,2,5/
DATA MX/5,1,4,3,10,2,2,2,2,2,17,4,4,5,5,0,0,3/
DATA BP/0,20,0.,0.,1000.,100.,-1000.,1469.6,0.,1469.6,587.84,587.84,
0.,0.,100.,100.,0.,0.,0.,0.,0.,0.,1./
DATA AT/87.260,0.,2600.,2600.,2600.,2600.,300.,120.,120.,25.2,27.72.,
1.25.,56.,26.,41.,25.,25.,2600.,5000.,5000.,5000.,5000./
DATA DP/5.,40.,200.,1000.,4900.,2000.,1175.68,293.92,1175.68,
46.96,146.96,73.4,100.,100.,120.,20.,40.,40.,1./
DATA DT/400.,400.,400.,800.,600.,100.,30.,30.,12.6,9.,1.6,9.,5.,
0.,8.,4.,8.,200./
DATA TL/24.,846,27.175,29.310,31.299,33.176,36.962,36.672,38.317,
39.304,41.456/
PRES=
TR=KTRANS
F(P,LT,1.0) P=1.0
S=TEMP
F(T,LT,126.) GO TO 9
F(T,LT,2600.) GO TO 5
F(T,GE,6000.) T=5999.99999
F(P,GE,100.) GO TO 3
F(P,GE,30.) GO TO 2
F(P,GE,5.)GO TO 20
S=19

```

```

M1=21
GO TO 33
3 IF(P-GE.1000.) GO TO 4
M=3
M1=22
GO TO 33
4 M=4
M1=23
GO TO 33
5 IF(T.LT.300.) GO TO 7
IF(T.LT.800.) GO TO 6
M=5
GO TO 33
6 M=6
GO TO 33
7 IF(P.LT.1469.6) GO TO 8
M=7
GO TO 33
8 M=8
GO TO 33
9 IF(P.LT.587.84) GO TO 12
IF(P.LT.1469.6) GO TO 10
M=9
GO TO 33
10 IF(P.LT.1028.72.AND.T-GE.72.0.AND.T.LT.90.0) GO TO 11
4=10
GO TO 30
11 M=11
GO TO 33
12 IF(T.LT.81.) GO TO 13
GO TO 33
13 IF(P.LT.160.) GO TO 15
TM=((-.86867647E-7)*P-.12613701E-3)*P+.10353333)*P+.43.8056678
IF(T-GE.TM) GO TO 14
M=13
GO TO 30
14 M=14
GO TO 33
15 DO 16 I=2,12
IF(P-PS(I)) I7,I7.16
16 CONTINUE
I=12
17 TM=TS(I-1)+(TS(I)-TS(I-1))*(P-PS(I-1))/(PS(I)-PS(I-1))
IF(T-GE.TM) GO TO 18
M=15
IF(P.LT.40.) N=17
GO TO 30
18 M=16
IF(P.LT.40.) N=18
GO TO 32
30 F=P/587.84
33 IF(T.LE.5000.0) N1=M
M1=19
GO TO 33
20 M=1
M1=20
GO TO 33
2 M=2
M1=21
GO TO 33
3 IF(P-GE.1000.) GO TO 4
M=3
M1=22
GO TO 33
4 M=4
M1=23
GO TO 33
5 IF(T.LT.300.) GO TO 7
IF(T.LT.800.) GO TO 6
M=5
GO TO 33
6 M=6
GO TO 33
7 IF(P.LT.1469.6) GO TO 8
M=7
GO TO 33
8 M=8
GO TO 33
9 IF(P.LT.587.84) GO TO 12
IF(P.LT.1469.6) GO TO 10
M=9
GO TO 30
10 IF(P.LT.1028.72.AND.T-GE.72.0.AND.T.LT.90.0) GO TO 11
M=8
GO TO 33
9 IF(P.LT.587.84) GO TO 12
IF(P.LT.1469.6) GO TO 10
M=9
GO TO 30
10 IF(P.LT.1028.72.AND.T-GE.72.0.AND.T.LT.90.0) GO TO 11
N=10
GO TO 30
11 M=11
GO TO 33
12 IF(T.LT.81.) GO TO 13
GO TO 33
13 IF(P.LT.160.) GO TO 15
TM=((-.86867647E-7)*P-.12613701E-3)*P+.10353333)*P+.43.8056678
IF(T-GE.TM) GO TO 14
M=13
GO TO 30
14 M=14
GO TO 33
15 DO 16 I=2,12
IF(P-PS(I)) I7,I7.16
16 CONTINUE
I=12
17 TM=TS(I-1)+(TS(I)-TS(I-1))*(P-PS(I-1))/(PS(I)-PS(I-1))
IF(T-GE.TM) GO TO 18
M=15
IF(P.LT.40.) N=17
GO TO 30
18 M=16
IF(P.LT.40.) N=18
GO TO 32
30 F=P/587.84
33 IF(T.LE.5000.0) N1=M

```

```

FP=(P-BP(N))/DP(N)
IP=FP
IF(IP.GT.8) I=0
FI=I
F=F-FI
TQ=(1.0-F)*TL(I+1)+F*TL(I+2)
IF(T.LT.TQ) T=TQ
33 IF(T.LE.5000.)NI=N
FP=(P-BP(N))/DP(N)
IP=FP
IF(IP.GT.MX(N)) IP=MX(N)
FI=IP
F=FP-FI
FP=1.0-F
FT=(T-BT(N1))/DT(N)
IT=FT
FI=FI
FF=FT-FI
FT=1.0-FF
I=I+JP(N)+IP*LOC(N1)
J=I+JP(N)
IF(KTR.EQ.2) GO TO 37
CTCP=FP*FT*CV(I)+F*FT*CP(I+1)+FP*FF*CP(J)+F*FF*CP(J+1)
IF(N.LT.13-OR.N.GE.17) GO TO 36
IF(N.LT.15) GO TO 35
CTCP=CTCP/(187.506-P*ABS(T-TM)*28.13)
GO TO 36
35 CTCP=CTCP/LABS(T-TM)/1.8+ABS(P-187.506)*.008000982)
36 IF(KTR.GE.2) GO TO 37
PTCP=CTCP
RETURN
37 PTCP=FP*FT*CV(I)+F*FT*CV(I+1)+FP*FF*CV(J)+F*FF*CV(J+1)
IF(KTR.LT.3) RETURN
PTCP=CTCP/PTHEAT
RETURN
END

BLOCK DATA
COMMON/SPHEAT/AA(111),AB(111),AC(111),AD(111),AE(116),AF(112),
1AG(111),AH(40),
2 AI(110),AJ(111),AK(111),AL(111),AM(116),AN(112),AO(111)
3,AP(41)
DATA/3.804,3.796,3.794,3.793,3.793,3.793,3.793,3.793,3.951,3.937
1,3.931,3.927,3.924,3.922,4.655,4.259,4.184,4.15,4.13,4.117,4.107,6
2,495,5.032,4.755,4.632,4.559,4.509,4.472,10.986,8.839,6.054,5.706,5
3,498,5.356,5.252,20.06,10.48,8.646,7.834,7.35,7.026,7.76,35.35,16
483,13.18,11.55,10.59,9.919,9.429,3.793,3.793,3.793,3.793,3.924,3.917,3.9
6,5.62,9.936,7.923,7.103,3.793,3.793,3.791,3.791,3.791,3.791,3.916,3
7,91,3.908,3.907,3.906,3.905,4.075,4.043,4.031,4.025,4.022,4.02,4.3
86,4.236,4.102,4.172,4.161,4.183,4.933,4.581,4.457,4.401,4.369,4.34
96,6.03,5.214,4.92,4.791,4.715,4.759,7.93,6.276,5.692,5.433,5.279/
DATA/5.17,3.79,3.793,3.789,3.789,3.789,3.789,3.789,4.014,4.014,4.0
108,4.346,4.29,4.265,4.25,4.245,4.173,4.912,4.796,4.726,4.679,3.47,3
2,511,3.504,3.507,3.624,3.622,3.792,3.789,3.744,4.108,4.297,4.346,3
3,650,3.842,3.961,4.015,3.537,3.637,3.703,3.749,3.479,3.555,3.579,3
4,508,3.461,3.493,3.523,3.542,3.451,3.476,3.494,3.511,2.586,2.981,3
5,996,3.693,3.806,3.785,3.834,3.187,3.036,2.861,3.089,3.309,3.498,3
6,628,3.693,3.643,3.501,3.379,3.342,3.342,3.474,3.584,3.673,3.737,3.8,

```

```

937,4,339,4,884,3,879,3,715,4,14,4,37,4,391,4,286,4,134,3,98,3,841,3
DATA(CP(1),I=327,3,375,3,956,4,869,4,883,4,803,3,954,3,863,3,812,3
1,505,3,692,3,319,3,3,881,3,691,3,688,3,824,3,376,3,516,3,654,3,712,3
2,77,3,769,3,767,5,417,4,486,3,997,3,69,5,82,4,795,4,229,3,862,5,80
37,5,822,4,43,4,833,5,639,5,107,4,573,4,163,5,23,5,85,4,643,4,251,
4,85,4,693,4,637,3,339,2,47,2,73,3,877,3,551,4,392,3,956,5,659,5,
594,6,5,793,2,482,2,678,2,316,3,205,3,549,3,916,4,304,4,637,4,4,2,
658,3,2,656,2,633,3,833,3,295,3,496,3,725,3,949,4,2,2,535,2,659,2,7
795,2,942,3,3,3,264,3,43,3,59,3,735,2,592,2,683,2,792,2,987,3,826,3
8,14,3,27,3,391,3,505,2,641,2,731,2,622,2,913,3,3,3,003,3,007,3,191,3
9284,3,378,25,22,30,03,35,661,40,25,44,37,48,45,24,47,30,12,36,7)
END

SUBROUTINE DATA1
COMMON/SPEAT(CP(823),CV(823))
DATA(CP(1),I=835,547,42,16,47,88,51,94,22,95,29,45,36,95,43,16,4
11,74,54,28,20,18,27,69,36,2,43,19,49,43,15,55,58,16,12,24,74,34,5,42,
23,49,15,55,9,10,320,663,31,93,40,59,44,07,55,44,1,498,15,13,28,59
338,11,46,15,53,98,19,29,10,62,24,31,35,43,51,78,0,0,28,17,76,
34,48,56,39,53,48,33,0,55,4,28,17,23,31,9,42,56,0,0,9,13,79,1
57,32,36,11,93,5,256,1,59,0,11,6,88,15,48,11,4,18,13,56,0,0
6,23,81,18,76,13,42,1,69,1,78,8,9,31,85,25,95,2,7,16,43,13,21,19
7,31,38,05,2,91,34,23,2,08,7,8,45,44,95,39,57,39,67,34,66,34,9
85,24,46,1027,1,148,1,238,1,311,1,362,1,1407,1,1445,962,3,1099,1,1202
9,1205,1,1344,1,1394,1,438,1,869,1,1026,1,142,1,235,1,1303,1,1357,1
DATA(CP(1),I=848,656)=1405,727,5,906,9,1040,1,145,1,129,1,1282,1
1335,553,3,742,1,895,5,1016,1,099,1,1170,1,230,3,383,6,514,8,693,3,8
238,4,934,9,1045,1,808,9,1,2290,2,434,2,603,4,720,3,814,5,893,8,0
3,0,153,4,302,5,433,2,255,8,1,653,3,343,4,72,4,162,28,151,5,276,4
44,37,8,929,7,692,1,477,8,288,3,134,90,2,1,120,1,169,1,1269,1,1082,19
587,6,759,5,607,4,444,7,2037,1817,1636,1469,1,1331,1,1195,1,1053,2
65864,2363,2,180,2,2016,1,1881,1,751,1,620,3,3135,2,331,1,276,2,2583,2
747428,2299,2,173,3,566,1,557,1,78,17,2,059,2,037,2,377,2,233,2,9
8826,2,723,1,1,091,3,21,2,46,5,286,2,456,3,245,2,428,3,431,2,434,3,8025
9,2,461,2,813,1,463,2,7,2,465,2,638,2,47,2,613,35,34,16,83,13,18
DATA(CP(1),I=857,764)=11,55,10,9,919,9,429,54,51,26,45,20,19,1
17,34,15,62,14,45,13,58,64,37,38,42,29,61,25,31,2,66,20,81,19,43,5
128,3,49,66,39,93,4,49,30,98,28,41,26,46,9,931,7,923,7,103,15,162,1
430,9,4,17,22,66,15,12,12,73,20,94,20,32,16,05,7,93,6,276,5,632,5
4443,5,279,5,173,10,9,7,934,6,803,6,417,6,14,5,95,15,15,10,31,0,585
5,57,2,7,364,7,052,17,43,13,27,10,71,9,57,8,69,8,424,5,173,9,912,4
8,796,4,726,6,679,7,052,6,276,5,935,5,731,5,591,9,796,8,258,7,537,7
7,167,4,891,0,0,300,3,799,3,797,3,797,3,796,3,886,3,875,3,87,3,867,
3,865,4,01,3,979,3,965,3,956,3,951,4,216,4,1,4,106,4,085,4,072,4,
95576,4,408,4,333,4,289,4,259,5,19,1,885,4,707,4,4,106,4,558,6,102)
DATA(CP(1),I=8765,823)=5,585,5,308,5,5,44,5,032,7,785,6,713,6,238,5
4,1,954,5,761,10,15,8,386,7,619,7,12,10,47,4,48,10,4,15,86,14,32,13,26,31
2372,18,14,10,9,2,12,11,10,47,2,16,4,10,4,15,86,14,32,13,26,31
3,64,72,33,93,20,1,10,28,16,82,40,2,30,25,96,23,16,21,23,40,9,37,9
3,32,3,38,28,89,26,45,98,45,39,27,35,23,32,33,59,18,51,55,45,7
66,41,58,38,42,57,08,54,65,50,68,47,04,44,04)
END

SUBROUTINE C SUB V
COMMON/SPEAT(CP(823),CV(823))
DATA(CP(1),I=91,0,12,2,94,2,2,94,2,936,3,624,3,255,3,186,3,155,3,136
2,3,124,3,114,5,313,3,972,3,717,3,684,3,537,3,491,3,457,9,333,5,61,

```

```

3.4898,4.582,4.394,4.265,4.17,17.15,8.623,7.203,6.461,6.049,5.754,5
5.938,2.947,14.22,11.11,9.705,6.862,8.284,7.855,2.808,2.807,2.807,2
5.938,2.947,14.22,11.11,9.705,6.862,8.284,7.855,2.808,2.807,2.807,2
6.195,7.62,8.65,4.498,8.3,6.533,5.809,2.807,2.807,2.807,2.807,2.80
7.62,8.06,2.931,2.932,2.922,2.921,2.92,3.083,3.053,3.043,3.039
8.3,3.034,3.353,3.239,3.199,3.181,3.17,3.169,3.167,3.165,3.163
9.3,3.363,3.345,4.067,4.129,3.867,3.751,3.682,3.72,6.541,5.077)
DATA(CV(1),15109,216),4.557,4.327,4.189,4.095,2.72,6.541,5.077)
1.80,2.803,3.034,3.029,3.026,3.024,3.022,3.045,3.286,3.271,3.257,2
2.37,4.095,3.861,3.757,3.694,3.652,2.465,2.509,2.519,2.52,2.639,2
3.637,2.803,2.808,2.996,3.078,3.134,2.728,2.802,2.86,2.9,2.570
4.2,626,2.663,2.689,2.506,2.530,2.562,2.578,2.482,2.504,2.52,2.53,2
5.48,2.489,2.5,2.509,1.602,1.634,1.665,1.682,1.94,1.706,1.758,1.8
6.1,838,1.876,1.893,1.911,1.929,1.947,1.961,2.005,2.046,2.084,2.115
72,216,2.217,2.219,2.229,2.238,2.271,2.304,2.338,2.353,2.355,2.352
82,56,2.571,2.58,2.617,2.653,2.684,2.759,2.776,2.791,2.806,2.82,2.8
933,2.882,2.92,2.951,2.992,2.991,2.926,2.943,2.958,2.972,3.023)
DATA(CV(1),15217,328),3.062,3.093,2.94,2.956,2.973,2.989,3.003,3
1015,3.063,3.101,3.134,1.113,1.083,1.06,1.05,1.05,1.353,1.335,1.325,1.31
22,1.498,1.498,1.494,1.491,1.572,1.591,1.601,1.603,1.595,1.63,1.655
3.1,672,1.617,1.662,1.696,1.724,1.651,1.699,1.738,1.771,1.693,1.741
5.1,782,1.819,1.797,1.807,1.85,1.888,1.173,1.171,1.168,1.165,1.16,1
9.156,1.149,1.345,1.341,1.34,1.338,1.334,1.332,1.329,1.456,1.455,1
645,1.453,1.452,1.45,1.449,1.517,1.519,1.521,1.523,1.525,1.526,1.5
727,1.551,1.552,1.556,1.561,1.564,1.569,1.572,1.583,1.571,1.571,1.5
875,1.581,1.587,1.591,1.61,1.61,1.591,1.584,1.584,1.594,1.6,1.611
9.61,1.608,1.608,1.61,1.615,1.621,1.616,1.623,1.627,1.632,1.633)
DATA(CV(1),15325,432),1.641,1.646,1.632,1.64,1.646,1.653,1.659,1
1665,1.671,1.665,1.673,1.681,1.687,1.693,1.7,1.707,1.715,1.723,1.731
2.1,738,1.744,1.751,1.757,1.503,1.571,1.571,1.571,1.575,1.597,1.578,1.574
3.1,579,1.608,1.597,1.581,1.582,1.61,1.596,1.589,1.589,1.6,1.604,1.6
4.598,1.598,1.61,1.61,1.608,1.608,1.485,1.51,1.534,1.537,1.577,1.6
58,1.621,1.621,1.61,1.608,1.608,1.536,1.552,1.569,1.583,1.596,1.6
66,1.61,1.516,1.532,1.548,1.563,1.577,1.591,1.602,1.61,1.616,1.549
71.562,1.574,1.585,1.597,1.608,1.619,1.627,1.632,1.595,1.606,1.615
81.625,1.634,1.642,1.652,1.66,1.665,1.656,1.664,1.671,1.679,1.686,1
9.693,1.701,1.708,1.715,1.131,1.132,1.133,1.133,1.133,1.124)
END
SUBROUTINE DATA2
COMMON/SPHEAT/CP(823),CV(823)
DATA(CV(1),15433,545),1.239,1.238,1.237,1.236,1.235,1.342,1.339,1
1.335,1.332,1.33,1.328,1.417,1.412,1.409,1.406,1.404,1.402,1.464,1
2.662,1.461,1.459,1.457,1.456,1.501,1.497,1.495,1.495,1.495,1.495,1.5
3.5,1.535,1.523,1.52,1.52,1.522,1.522,1.754,1.78,1.564,1.546,1.541,1.541,1.5
4.943,2.3,1.71,1.505,1.564,1.557,0.2,4,1.808,1.653,1.594,1.573,0.0,1.62,1.683
5.0,1.62,1.683,1.624,1.591,1.583,2.3,3,1.0,1.632,1.608,1.33,1.376,2.608,1.568,0
6.2,608,1.56,0.0,1.522,1.66,1.736,1.617,1.495,0.1,527,1.589,1.679,1.603,1.609,1
7.9,1.663,1.609,1.56,1.522,1.563,1.606,1.648,1.627,1.601,1.52,1.551,1.579,1.613,1.6
81.579,1.613,1.622,1.609,1.151,1.152,1.152,1.152,1.152,1.152,1.153,1.324,1.321,1.321
9.243,1.242,1.241,1.241,1.24,1.24,1.24,1.24,1.327,1.326,1.325,1.324)
DATA(CV(1),15546,654),1.323,1.322,1.321,1.323,1.392,1.391,1.39,1.39
1.389,1.388,1.387,1.44,1.439,1.438,1.438,1.437,1.436,1.436,1.436,1.436,1.4
2.74,1.473,1.472,1.471,1.471,1.47,1.508,1.503,1.506,1.504,1.501,1.5
3.4,98,0.0,1.547,1.546,1.54,1.539,1.533,1.646,1.78,1.938,1.602,1
4.615,1.628,1.601,1.607,1.607,1.605,1.978,2.346,2.652,1.517,1
5.944,1.578,1.623,1.687,1.787,1.962,1.504,1.518,1.534,1.551,1.57,1.5
6.92,1.610,1.498,1.508,1.517,1.526,1.536,1.546,1.556,1.499,1.506,1.5

```

```

712.1.519,1.526,1.532,1.539,1.546,1.553,1.560,1.567,1.574,1.581,1.588,1.595,1.602,1.609,1.616,1.623,1.630,1.637,1.644,1.651,1.658,1.665,1.672,1.679,1.686,1.693,1.700,1.707,1.714,1.721,1.728,1.735,1.742,1.749,1.756,1.763,1.770,1.777,1.784,1.791,1.798,1.805,1.812,1.819,1.826,1.833,1.840,1.847,1.854,1.861,1.868,1.875,1.882,1.889,1.896,1.903,1.910,1.917,1.924,1.931,1.938,1.945,1.952,1.959,1.966,1.973,1.980,1.987,1.994,2.001,2.008,2.015,2.022,2.029,2.036,2.043,2.050,2.057,2.064,2.071,2.078,2.085,2.092,2.099,2.106,2.113,2.120,2.127,2.134,2.141,2.148,2.155,2.162,2.169,2.176,2.183,2.190,2.197,2.204,2.211,2.218,2.225,2.232,2.239,2.246,2.253,2.260,2.267,2.274,2.281,2.288,2.295,2.302,2.309,2.316,2.323,2.330,2.337,2.344,2.351,2.358,2.365,2.372,2.379,2.386,2.393,2.400,2.407,2.414,2.421,2.428,2.435,2.442,2.449,2.456,2.463,2.470,2.477,2.484,2.491,2.498,2.505,2.512,2.519,2.526,2.533,2.540,2.547,2.554,2.561,2.568,2.575,2.582,2.589,2.596,2.603,2.610,2.617,2.624,2.631,2.638,2.645,2.652,2.659,2.666,2.673,2.680,2.687,2.694,2.701,2.708,2.715,2.722,2.729,2.736,2.743,2.750,2.757,2.764,2.771,2.778,2.785,2.792,2.799,2.806,2.813,2.820,2.827,2.834,2.841,2.848,2.855,2.862,2.869,2.876,2.883,2.890,2.897,2.904,2.911,2.918,2.925,2.932,2.939,2.946,2.953,2.960,2.967,2.974,2.981,2.988,2.995,3.002,3.009,3.016,3.023,3.030,3.037,3.044,3.051,3.058,3.065,3.072,3.079,3.086,3.093,3.100,3.107,3.114,3.121,3.128,3.135,3.142,3.149,3.156,3.163,3.170,3.177,3.184,3.191,3.198,3.205,3.212,3.219,3.226,3.233,3.240,3.247,3.254,3.261,3.268,3.275,3.282,3.289,3.296,3.303,3.310,3.317,3.324,3.331,3.338,3.345,3.352,3.359,3.366,3.373,3.380,3.387,3.394,3.401,3.408,3.415,3.422,3.429,3.436,3.443,3.450,3.457,3.464,3.471,3.478,3.485,3.492,3.499,3.506,3.513,3.520,3.527,3.534,3.541,3.548,3.555,3.562,3.569,3.576,3.583,3.590,3.597,3.604,3.611,3.618,3.625,3.632,3.639,3.646,3.653,3.660,3.667,3.674,3.681,3.688,3.695,3.702,3.709,3.716,3.723,3.730,3.737,3.744,3.751,3.758,3.765,3.772,3.779,3.786,3.793,3.800,3.807,3.814,3.821,3.828,3.835,3.842,3.849,3.856,3.863,3.870,3.877,3.884,3.891,3.898,3.905,3.912,3.919,3.926,3.933,3.940,3.947,3.954,3.961,3.968,3.975,3.982,3.989,3.996,4.003,4.010,4.017,4.024,4.031,4.038,4.045,4.052,4.059,4.066,4.073,4.080,4.087,4.094,4.101,4.108,4.115,4.122,4.129,4.136,4.143,4.150,4.157,4.164,4.171,4.178,4.185,4.192,4.199,4.206,4.213,4.220,4.227,4.234,4.241,4.248,4.255,4.262,4.269,4.276,4.283,4.290,4.297,4.304,4.311,4.318,4.325,4.332,4.339,4.346,4.353,4.360,4.367,4.374,4.381,4.388,4.395,4.402,4.409,4.416,4.423,4.430,4.437,4.444,4.451,4.458,4.465,4.472,4.479,4.486,4.493,4.500,4.507,4.514,4.521,4.528,4.535,4.542,4.549,4.556,4.563,4.570,4.577,4.584,4.591,4.598,4.605,4.612,4.619,4.626,4.633,4.640,4.647,4.654,4.661,4.668,4.675,4.682,4.689,4.696,4.703,4.710,4.717,4.724,4.731,4.738,4.745,4.752,4.759,4.766,4.773,4.780,4.787,4.794,4.801,4.808,4.815,4.822,4.829,4.836,4.843,4.850,4.857,4.864,4.871,4.878,4.885,4.892,4.899,4.906,4.913,4.920,4.927,4.934,4.941,4.948,4.955,4.962,4.969,4.976,4.983,4.990,4.997,5.004,5.011,5.018,5.025,5.032,5.039,5.046,5.053,5.060,5.067,5.074,5.081,5.088,5.095,5.102,5.109,5.116,5.123,5.130,5.137,5.144,5.151,5.158,5.165,5.172,5.179,5.186,5.193,5.200,5.207,5.214,5.221,5.228,5.235,5.242,5.249,5.256,5.263,5.270,5.277,5.284,5.291,5.298,5.305,5.312,5.319,5.326,5.333,5.340,5.347,5.354,5.361,5.368,5.375,5.382,5.389,5.396,5.403,5.410,5.417,5.424,5.431,5.438,5.445,5.452,5.459,5.466,5.473,5.480,5.487,5.494,5.501,5.508,5.515,5.522,5.529,5.536,5.543,5.550,5.557,5.564,5.571,5.578,5.585,5.592,5.599,5.606,5.613,5.620,5.627,5.634,5.641,5.648,5.655,5.662,5.669,5.676,5.683,5.690,5.697,5.704,5.711,5.718,5.725,5.732,5.739,5.746,5.753,5.760,5.767,5.774,5.781,5.788,5.795,5.802,5.809,5.816,5.823,5.830,5.837,5.844,5.851,5.858,5.865,5.872,5.879,5.886,5.893,5.900,5.907,5.914,5.921,5.928,5.935,5.942,5.949,5.956,5.963,5.970,5.977,5.984,5.991,5.998,6.005,6.012,6.019,6.026,6.033,6.040,6.047,6.054,6.061,6.068,6.075,6.082,6.089,6.096,6.103,6.110,6.117,6.124,6.131,6.138,6.145,6.152,6.159,6.166,6.173,6.180,6.187,6.194,6.201,6.208,6.215,6.222,6.229,6.236,6.243,6.250,6.257,6.264,6.271,6.278,6.285,6.292,6.299,6.306,6.313,6.320,6.327,6.334,6.341,6.348,6.355,6.362,6.369,6.376,6.383,6.390,6.397,6.404,6.411,6.418,6.425,6.432,6.439,6.446,6.453,6.460,6.467,6.474,6.481,6.488,6.495,6.502,6.509,6.516,6.523,6.530,6.537,6.544,6.551,6.558,6.565,6.572,6.579,6.586,6.593,6.600,6.607,6.614,6.621,6.628,6.635,6.642,6.649,6.656,6.663,6.670,6.677,6.684,6.691,6.698,6.705,6.712,6.719,6.726,6.733,6.740,6.747,6.754,6.761,6.768,6.775,6.782,6.789,6.796,6.803,6.810,6.817,6.824,6.831,6.838,6.845,6.852,6.859,6.866,6.873,6.880,6.887,6.894,6.901,6.908,6.915,6.922,6.929,6.936,6.943,6.950,6.957,6.964,6.971,6.978,6.985,6.992,6.999,7.006,7.013,7.020,7.027,7.034,7.041,7.048,7.055,7.062,7.069,7.076,7.083,7.090,7.097,7.104,7.111,7.118,7.125,7.132,7.139,7.146,7.153,7.160,7.167,7.174,7.181,7.188,7.195,7.202,7.209,7.216,7.223,7.230,7.237,7.244,7.251,7.258,7.265,7.272,7.279,7.286,7.293,7.300,7.307,7.314,7.321,7.328,7.335,7.342,7.349,7.356,7.363,7.370,7.377,7.384,7.391,7.398,7.405,7.412,7.419,7.426,7.433,7.440,7.447,7.454,7.461,7.468,7.475,7.482,7.489,7.496,7.503,7.510,7.517,7.524,7.531,7.538,7.545,7.552,7.559,7.566,7.573,7.580,7.587,7.594,7.601,7.608,7.615,7.622,7.629,7.636,7.643,7.650,7.657,7.664,7.671,7.678,7.685,7.692,7.699,7.706,7.713,7.720,7.727,7.734,7.741,7.748,7.755,7.762,7.769,7.776,7.783,7.790,7.797,7.804,7.811,7.818,7.825,7.832,7.839,7.846,7.853,7.860,7.867,7.874,7.881,7.888,7.895,7.902,7.909,7.916,7.923,7.930,7.937,7.944,7.951,7.958,7.965,7.972,7.979,7.986,7.993,8.000,8.007,8.014,8.021,8.028,8.035,8.042,8.049,8.056,8.063,8.070,8.077,8.084,8.091,8.098,8.105,8.112,8.119,8.126,8.133,8.140,8.147,8.154,8.161,8.168,8.175,8.182,8.189,8.196,8.203,8.210,8.217,8.224,8.231,8.238,8.245,8.252,8.259,8.266,8.273,8.280,8.287,8.294,8.301,8.308,8.315,8.322,8.329,8.336,8.343,8.350,8.357,8.364,8.371,8.378,8.385,8.392,8.399,8.406,8.413,8.420,8.427,8.434,8.441,8.448,8.455,8.462,8.469,8.476,8.483,8.490,8.497,8.504,8.511,8.518,8.525,8.532,8.539,8.546,8.553,8.560,8.567,8.574,8.581,8.588,8.595,8.602,8.609,8.616,8.623,8.630,8.637,8.644,8.651,8.658,8.665,8.672,8.679,8.686,8.693,8.700,8.707,8.714,8.721,8.728,8.735,8.742,8.749,8.756,8.763,8.770,8.777,8.784,8.791,8.798,8.805,8.812,8.819,8.826,8.833,8.840,8.847,8.854,8.861,8.868,8.875,8.882,8.889,8.896,8.903,8.910,8.917,8.924,8.931,8.938,8.945,8.952,8.959,8.966,8.973,8.980,8.987,8.994,9.001,9.008,9.015,9.022,9.029,9.036,9.043,9.050,9.057,9.064,9.071,9.078,9.085,9.092,9.099,9.106,9.113,9.120,9.127,9.134,9.141,9.148,9.155,9.162,9.169,9.176,9.183,9.190,9.197,9.204,9.211,9.218,9.225,9.232,9.239,9.246,9.253,9.260,9.267,9.274,9.281,9.288,9.295,9.302,9.309,9.316,9.323,9.330,9.337,9.344,9.351,9.358,9.365,9.372,9.379,9.386,9.393,9.400,9.407,9.414,9.421,9.428,9.435,9.442,9.449,9.456,9.463,9.470,9.477,9.484,9.491,9.498,9.505,9.512,9.519,9.526,9.533,9.540,9.547,9.554,9.561,9.568,9.575,9.582,9.589,9.596,9.603,9.610,9.617,9.624,9.631,9.638,9.645,9.652,9.659,9.666,9.673,9.680,9.687,9.694,9.701,9.708,9.715,9.722,9.729,9.736,9.743,9.750,9.757,9.764,9.771,9.778,9.785,9.792,9.799,9.806,9.813,9.820,9.827,9.834,9.841,9.848,9.855,9.862,9.869,9.876,9.883,9.890,9.897,9.904,9.911,9.918,9.925,9.932,9.939,9.946,9.953,9.960,9.967,9.974,9.981,9.988,9.995,10.002,10.009,10.016,10.023,10.030,10.037,10.044,10.051,10.058,10.065,10.072,10.079,10.086,10.093,10.100,10.107,10.114,10.121,10.128,10.135,10.142,10.149,10.156,10.163,10.170,10.177,10.184,10.191,10.198,10.205,10.212,10.219,10.226,10.233,10.240,10.247,10.254,10.261,10.268,10.275,10.282,10.289,10.296,10.303,10.310,10.317,10.324,10.331,10.338,10.345,10.352,10.359,10.366,10.373,10.380,10.387,10.394,10.401,10.408,10.415,10.422,10.429,10.436,10.443,10.450,10.457,10.464,10.471,10.478,10.485,10.492,10.499,10.506,10.513,10.520,10.527,10.534,10.541,10.548,10.555,10.562,10.569,10.576,10.583,10.590,10.597,10.604,10.611,10.618,10.625,10.632,10.639,10.646,10.653,10.660,10.667,10.674,10.681,10.688,10.695,10.702,10.709,10.716,10.723,10.730,10.737,10.744,10.751,10.758,10.765,10.772,10.779,10.786,10.793,10.800,10.807,10.814,10.821,10.828,10.835,10.842,10.849,10.856,10.863,10.870,10.877,10.884,10.891,10.898,10.905,10.912,10.919,10.926,10.933,10.940,10.947,10.954,10.961,10.968,10.975,10.982,10.989,10.996,11.003,11.010,11.017,11.024,11.031,11.038,11.045,11.052,11.059,11.066,11.073,11.080,11.087,11.094,11.101,11.108,11.115,11.122,11.129,11.136,11.143,11.150,11.157,11.164,11.171,11.178,11.185,11.192,11.199,11.206,11.213,11.220,11.227,11.234,11.241,11.248,11.255,11.262,11.269,11.276,11.283,11.290,11.297,11.304,11.311,11.318,11.325,11.332,11.339,11.346,11.353,11.360,11.367,11.374,11.381,11.388,11.395,11.402,11.409,11.416,11.423,11.430,11.437,11.444,11.451,11.458,11.465,11.472,11.479,11.486,11.493,11.500,11.507,11.514,11.521,11.528,11.535,11.542,11.549,11.556,11.563,11.570,11.577,11.584,11.591,11.598,11.605,11.612,11.619,11.626,11.633,11.640,11.647,11.654,11.661,11.668,11.675,11.682,11.689,11.696,11.703,11.710,11.717,11.724,11.731,11.738,11.745,11.752,11.759,11.766,11.773,11.780,11.787,11.794,11.801,11.808,11.815,11.822,11.829,11.836,11.843,11.850,11.857,11.864,11.871,11.878,11.885,11.892,11.899,11.906,11.913,11.920,11.927,11.934,11.941,11.948,11.955,11.962,11.969,11.976,11.983,11.990,11.997,12.004,12.011,12.018,12.025,12.032,12.039,12.046,12.053,12.060,12.067,12.074,12.081,12.088,12.095,12.102,12.109,12.116,12.123,12.130,12.137,12.144,12.151,12.158,12.165,12.172,12.179,12.186,12.193,12.200,12.207,12.214,12.221,12.228,12.235,12.242,12.249,12.256,12.263,12.270,12.277,12.284,12.291,12.298,12.305,12.312,12.319,12.326,12.333,12.340,12.347,12.354,12.361,12.368,12.375,12.382,12.389,12.396,12.403,12.410,12.417,12.424,12.431,12.438,12.445,12.452,12.459,12.466,12.473,12.480,12.487,12.494,12.501,12.508,12.515,12.522,12.529,12.536,12.543,12.550,12.557,12.564,12.571,12.578,12.585,12.592,12.599,12.606,12.613,12.620,12.627,12.634,12.641,12.648,12.655,12.662,12.669,12.676,12.683,12.690,12.697,12.704,12.711,12.718,12.725,12.732,12.739,12.746,12.753,12.760,12.767,12.774,12.781,12.788,12.795,12.802,12.809,12.816,12.823,12.830,12.837,12.844,12.851,12.858,12.865,12.872,12.879,12.886,12.893,12.900,12.907,12.914,12.921,12.928,12.935,12.942,12.949,12.956,12.963,12.970,12.977,12.984,12.991,12.998,13.005,13.012,13.019,13.026,13.033,13.040,13.047,13.054,13.061,13.068,13.075,13.082,13.089,13.096,13.103,13.110,13.117,13.124,13.131,13.138,13.145,13.152,13.159,13.166,13.173,13.180,13.187,13.194,13.201,13.208,13.215,13.222,13.229,13.236,13.243,13.250,13.257,13.264,13.271,13.278,13.285,13.292,13.299,13.306,13.313,13.320,13.327,13.334,13.341,13.348,13.355,13.362,13.369,13.376,13.383,13.390,13.397,13.404,13.411,13.418,13.425,13.432,13.439,13.446,13.453,13.460,13.467,13.474,13.481,13.488,13.495,13.502,13.509,13.516,13.523,13.530,13.537,13.544,13.551,13.558,13.565,13.572,13.579,13.586,13.593,13.600,13.607,13.614,13.621,13.628,13.635,13.642,13.649,13.656,13.663,13.670,13.677,13.684,13.691,13.698,13.705,13.712,13.719,13.726,13.733,13.740,13.747,13.754,13.761,13.768,13.775,13.782,13.789,13.796,13.803,13.810,13.817,13.824,13.831,13.838,13.845,13.852,13.859,13.866,13.873,13.880,13.887,13.894,13.901,13.908,13.915,13.922,13.929,13.936,13.943,13.950,13.957,13.964,13.971,13.978,13.985,13.992,14.000,14.007,14.014,14.021,14.028,14.035,14.042,14.049,14.056,14.063,14.070,14.077,14.084,14.091,14.098,14.105,14.112,14.119,14.126,14.133,14.140,14.147,14.154,14.161,14.168,14.175,14.182,14.189,14.196,14.203,14.210,14.217,14.224,14.231,14.238,14.245,14.252,14.259,14.266,14.273,14.280,14.287,14.294,14.301,14.308,14.315,14.322,14.329,14.336,14.343,14.350,14.357,14.364,14.371,14.378,14.385,14.392,14.399,14.406,14.413,14.420,14.427,14.434,14.441,14.448,14.455,14.462,14.469,14.476,14.483,14.490,14.497,14.504,14.511,14.518,14.525,14.532,14.539,14.546,14.553,14.560,14.567,14.574,14.581,14.588,14.595,14.602,14.609,14.616,14.623,14.630,14.637,14.644,14.651,14.658,14.665,14.672,14.679,14.686,14.693,14.700,14.707,14.714,14.721,14.728,14.735,14.742,14.749,14.756,14.763,14.770,14.777,14.784,14.791,14.798,14.805,14.812,14.819,14.826,14.833,14.840,14.847,14.854,14.861,14.868,14.875,14.882,14.889,14.896,14.903,14.910,14.917,14.924,14.931,14.938,14.945,14.952,14.959,14.966,14.973,14.980,14.987,14.994,15.001,15.008,15.015,15.022,15.029,15.036,15.043,15.050,15.057,15.064,15.071,15.
```

```

2,1895..1690..2389..2220..2106..2745..2573..2459..3058..2874..2762.
3,3311..3138..3811..3522..3335..3216..3704..3315..3394..3860..3669.
4,3547..3993..3808..3676..4189..3915..3798..4213..4018..3890..4304.
5,4111..3903..4383..4195..4067..4458..4279..4144..4022..2522..4000.
6,808..2557..2876..3567..4008..0..0..2711..2888..3152..3509..3908.
7,5125..2839..2942..3868..3226..3411..3693..2940..3032..3091..3184.
8,3591..3376..3037..3052..3149..3218..3275..3345..3291..3230..3120.
9,3316..3081..1643..0..5465..4047..2559..469..5663..5229..3763..2207..7893..6460..5025.
DATA(C(1),I=219,32)=2287.7893.6460.5025.3339.9168.7722.63
186..4884..10450..9008..7682..6214..11768..10320..8917..7532..2311.
2,2895..1712..2110..1787..1320..1453..1416..808..70..2017..377..20.
3,1184..601..61882..6607..7225..9829..11928..14868..877..93856..65
4,92..9851..11418..13638..1100..4829..6455..8789..11060..13210..927
5,31743..7856..8834..10908..12978..0..0..2666..7685..10270..12620..
6-177..9..1148..0..2542..0301..11238..1389..4017..8470..7587..0..0..
72333..4413..6493..8368..8974..0..3598..4681..6388..8346..9534..107
820..4685..5588..6888..8689..9978..11808..5622..6503..7806..8991..1
90538..11928..6619..7455..8453..9688..11050..12510..7638..8426.
P=PRES
IF(P.LT.1.0) P=1.0
T=TEMP
IF(T.GE.600.0) T=5399.9999
CIV=1.8
IF(T.GE.100.0) GO TO 15
T2=24.84+.00317*P
IF(T.LT.T2) T=T2
IF(P.GE.700.0) GO TO 4
IF(P.GE.80.0) GO TO 3
IF(P.LT.187.596) GO TO 7
IF(T.LT.56.0) GO TO 12
IF(P.GT.488.0) GO TO 2
IF(T.GE.T4) GO TO 1
DIV=((P-187.596)*.003+T-T1)/10.
GO TO 33
1 M=8
DIV=((P-187.596)*.003+T-T1)/10.
GO TO 33
2 M=9
GO TO 33
3 M=11
GO TO 33
4 IF(P.GE.2508.0) GO TO 6
IF(T.GE.68.0) GO TO 5
M=2
GO TO 33
5 M=18
GO TO 33
6 M=3
GO TO 33
7 DO 8 I=2,19
IF(P-PS(I)) 10,9,8
8 CONTINUE
9 TM=TS(I)
GO TO 11
10 TM=TS(I-1)+(TS(I)-TS(I-1))*(P-PS(I-1))/(PS(I)-PS(I-1))
11 IF(T.GE.TM) GO TO 13

```

```

DATA(B/3353..3247..3161..3941..3703..3356..3445..3356..4173..3889.
1,3729..3613..3522..1562..1327..0..1972..1805..1690..2389..2220..21
206..2745..2573..2459..3058..2874..2762..3311..3130..3011..3522..33
335..3216..3704..3515..3394..3860..3669..3547..3993..3808..3676..41
409..3315..3798..4213..4018..3890..4304..4111..3903..4383..4195..40
567..4450..4270..4144..4022..2522..4000..0..0..2711..2888..3152..3509..3908
600..0..0..2711..2888..3152..3509..3908..5125..2839..2942..3868..3226
726..3411..3693..2940..3012..3091..3161..3261..3376..3037..3092..31
849..3210..3275..3345..3291..2340..12..0..4316..3001..1643..0..5465
9..4047..2559..469..5663..5229..3763..2207..7893..6460..5025.
DATA(C/3539..9168..7722..6306..4884..10450..9008..7602..6214..1176
10..10320..8917..7532..2311..2005..1712..2110..1707..1320..1453..14
216..888..70..2017..377..20..1184..601..61802..4607..7225..9629..1
31920..14060..877..93856..6592..9051..11410..13630..1100..4828..645
45..8789..11060..13210..927..177..9..1148..0..2542..0301..11238..1389
5..2666..7685..10270..12620..927..177..9..1148..0..2542..0301..11238..1389
69..4017..8470..7587..0..0..2353..4013..6493..8368..8974..0..3599..
74681..6388..8346..9534..10270..4605..5580..6880..8689..9970..11040
8..5622..6503..7806..8991..10530..11920..16619..7455..8453..9688..11
9050..12510..7638..8426..9358..10450..11720..13110..4269..4191.
DATA(D/4126..4079..4022..3979..3941..4552..4439..4351..4277..4216.
1..4163..4115..4903..4715..4588..4489..4410..4343..4286..5419..5878.
2..4859..4710..4607..4524..4454..4356..4349..4286..4184..4072..4818..4699.
3..4616..6232..5879..5474..5222..5035..4893..4780..5038..5894..5626.
4..5402..5211..5058..4934..5361..5552..5555..5447..5306..5171..5051.
5..4977..5210..5333..5349..5294..5208..5115..4173..3889..3729..3613.
6..3522..4723..4243..4088..3958..3860..5130..4525..4350..4211..4109.
7..4954..4799..4535..4403..4304..4663..4888..4652..4538..4450..4307.
8..3618..4721..5407..5130..3882..3600..4324..5044..5089..3127..3573.
9..4165..4702..4949..3173..3562..4052..4499..4781..3220..3564.
DATA(E/3976..4362..4635..3223..4580..4803..4576..4450..4351..4270.
1..4202..4144..3450..4286..4743..4731..4669..4603..4539..4480..4426.
2..3712..4278..4657..4796..4826..4809..4774..4733..4688..4601..4497.
3..4612..4987..5080..5088..5074..5051..5019..4421..4770..5035..5211.
4..5310..5353..5365..5361..5346..4420..5035..5310..5365..5346..5677.
5..5973..6138..6222..6268..5910..6069..6179..6246..6287..5835..5946.
6..6022..6073..6109..5784..5841..5898..5955..6012..5784..5891..6171.
7..6092..6545..6444..7011..7288..7594..7901..8337..8405..8337..8250.
8..8212..8189..8174..8924..8731..8636..8579..8540..9956..9435..9319.
9..9193..9108..11700..10760..10390..10190..10100..10670..12910.
DATA(F/12130..11690..11450..19300..16260..14900..14150..13590..261
190..21230..19000..17760..16840..35940..28270..24838..22870..21450.
2..46990..37820..32740..29840..27790..65540..50130..43030..39020..36
3020..85130..65220..56090..50400..46470..1..06365..82580..71370..6413
40..56900..1..26155..10455..88280..79430..73090..1..42255..1..18755..105
5255..95480..83320..1..43855..1..33455..1..19855..1..10455..1..03155..1..39255.
61..36955..1..29555..1..2155..1..15755..8211..8135..8109..8099..8636..8445
7..8378..8350..9320..8895..8745..8680..10490..9536..9234..9146..123
860..10540..9980..9830..15190..12140..11160..10830..19370..14490..1
92870..12270..25320..17800..15270..14290..33410..2320..18540..1
DATA(G/17020..43970..28250..22840..20570..57160..35780..28330..251
180..72840..44970..35100..30840..35040..355770..43180..37570..1..087E
25..67930..52540..45530..1..25455..80760..62850..54720..1..38E5..93430.
373790..64480..8117..8093..8084..9324..8748..8645..11930..10460..99
473..18510..14570..13000..32030..22950..19090..54800..37230..29540.
5..85310..57530..44660..8079..8087..8118..8936..8566..8590..10740..)
6551..9316..13860..11610..10820..24500..15630..13460..40390..122530.
7..18040..16360..32850..124920..8059..8235..8405..8588..8723..8892..9

```



```

IF (T.LT.56.0) GO TO 12
N=6
DIV=((187.506-P)*.083+TM-T)/10.
GO TO 33
12 N=1
GO TO 33
13 IF (P.GE.100.0) GO TO 14
N=4
GO TO 33
14 N=5
DIV=((187.506-P)*.083+TM-T)/10.
GO TO 33
15 IF (T.GE.3000.0) GO TO 18
IF (T.GE.500.0) GO TO 17
IF (T.GE.100.0) GO TO 16
N=12
GO TO 33
16 N=13
GO TO 33
17 N=14
GO TO 33
18 IF (P.GE.30.0) GO TO 20
IF (P.GE.5.0) GO TO 19
N=15
GO TO 33
19 N=16
GO TO 33
20 IF (P.GE.500.0) GO TO 22
IF (P.GE.100.0) GO TO 21
N=17
GO TO 33
21 N=18
GO TO 33
22 N=19
GO TO 33
33 FP=(P-BP(N))/DP(N)
IP=FP
IF (IP.GT.MX(N)) IP=MX(N)
F=FP-IP
FP=1.0-F
IT=(T-BT(N))/DT(N)
IT=FT
FF=FT-IT
FI=1.0-FF
I=IT*JP(N)+IP+LOC(N)
J=I+JP(N)
PTLFAC=(FP*FT*CI)+F*FT*CI(I+1)+FP*FF*CI(J)+F*FF*CI(J+1)/DIV
RETURN
END

SUBROUTINE PTLFOATA
COMMON/PTLFAC /C(730)
DATA (C(I),I=325,429)=9350.,10450.,11720.,13110.,14269.,4191.,4126.
1,4870.,4822.,3979.,3941.,4552.,4439.,4351.,4277.,4216.,4163.,4115.
2,4903.,4715.,4588.,4489.,4410.,4347.,4286.,4219.,4150.,4078.,4015.
3,4687.,4524.,4434.,4356.,4279.,4194.,4122.,4053.,3983.,3910.,3838.
4,3879.,3674.,3522.,3405.,3293.,3180.,3068.,2956.,2844.,2732.
5,2505.,2334.,2161.,2000.,1838.,1676.,1514.,1352.,1190.,1028.
6,5333.,5349.,5294.,5200.,5115.,5029.,4943.,4859.,4775.,4691.

```

```

7.4243..4888..3958..5138..4525..4358..4211..4109..4954..4799.
8.4535..4463..4304..4653..4888..4652..4538..4458..4307..4721.
9.5407..5138..3802..3602..4324..5044..5089..3127..3573..4135..
DATA(C11),1.430,532) 4.702..4949..3173..3562..4052..4499..4781..32
120..3564..3976..4362..4635..3223..4580..4803..4576..4450..4351..42
278..4202..4144..3450..4286..4743..4731..4669..4603..4339..4480..44
326..3712..4278..4647..4798..4826..4809..4774..4733..4688..4061..44
437..4812..4967..5060..5080..5074..5051..5019..4423..4770..5035..52
511..5310..5353..5365..5361..5346..4420..5035..5310..5365..5346..56
677..45973..1.6137..8.6220..6.6268..1.5909..9.6869..6.179..6246..6287..58
735..5946..6022..6073..6109..5784..5841..5898..5955..6012..5784..58
891..4.6171..6092..4.6544..9.6444..5.7011..7287..9.7594..7901..8337..640
95..8337..8250..1.8211..9.8189..1.8173..7.8923..6.8731..8635..8579..
DATA(C11),1.533,622) 8.940..9956..9434..7.9319..9193..1.107..6.11702.
1.18761..1.0388..1.0190..1.0115..1.14672..1.2910..1.2128..1.1691..1.1453..19
2385..1.6256..1.4900..1.4149..1.3595..2.6195..2.1226..1.8998..1.7761..1.6043
3..35937..28274..24829..2.2875..2.1450..4.8995..3.7818..3.2739..2.9840..2
47793..65538..50134..4.735..3.9022..3.6021..85130..65221..56088..5040
54..44666..166326..7.2576..7.1371..6.4130..5.8905..1.26126..1.00980..8028
68..79433..73891..14.2184..1.18704..1.05208..99480..88316..146831..133
7421..1.19808..1.18400..1.03108..1.39178..1.38471..1.29500..1.22100..1.1570
88..8211..8135..5.8109..4.8098..6.0636..8.445..2.8378..4.8349..6.9320..889
94..8745..1.8679..5.18494..9.5364..4.9236..9.146..3.12362..1.0544..1.9980..2
DATA(C11),1.6623..7.15) 8.9429..8.15185..12141..1.1159..1.0831..1.9370..14
1484..12868..1272..25317..17799..15272..14289..33410..22316..18541
2..17024..43972..28250..2242..2.20572..57156..35776..28326..25156..7
32837..44973..35896..3.0635..9.0411..5.771..4.3180..37525..108699..679
433..52573..45529..1.25441..8.8759..6.2550..5.4721..1.37972..93428..7379
53..44475..817..8093..8.054..9324..8748..8645..1.1932..1.0464..9973..
618595..14573..12999..32032..22948..1.9007..54798..37234..29542..253
713..5752..44857..8079..8007..8.118..8936..8566..8598..10748..9751.
89346..13865..11613..1.0816..2.4504..1.5632..1.3484..4.0394..122532..1.88
938..63303..32848..2.4918..8.059..827..8405..8588..8723..8892..
DATA(C11),1.716,730) 9.346..9257..9478..1.1039..1.0318..1.0268..1.4191
1..12889..1.1588..1.3627..1.4868..1.3761..2.7813..1.917..1.6979..
END

```

```

FUNCTION TSATH(TEMP,MG,ML)
DIMENSION R(19),TL(19),TG(19),TF(19)
DATA R/1.022,2.0,4.0,8.0,14.0,25.0,43.0,69.0,99.0,128.0,151.0,
1165.,176.0,182.0,185.0,186.5,187.25,187.46875,187.506/
DATA
227.07,29.81,33.07,36.18,39.96,44.12,48.33,51.97,54.79,56.72,57.80,
358.57,58.99,59.18,59.29,59.34,59.353,59.356/
DATA
4.76,35.80,98.85,11.87,40.86,54.81,94.74,15.64,83.56,86.47,34.39,56
5.33,46.28,34.22,31.18,56.16,55/
DATA
6.-110.86,-101.3,-89.04,-74.22,-58.56,-43.43,-30.07,-20.56,-11.13,
7-4.27,1.17,5.54,10.83,14.29,16.36/
T=TEMP
IF(T.LT.24.845) T=24.845
IF(T.GE.59.356) T=59.356

```

```

FUNCTION TSATH(TEMP,MG,ML)
DIMENSION R(19),TL(19),TG(19),TF(19)
DATA R/1.022,2.0,4.0,8.0,14.0,25.0,43.0,69.0,99.0,128.0,151.0,
1165.,176.0,182.0,185.0,186.5,187.25,187.46875,187.506/
DATA
227.07,29.81,33.07,36.18,39.96,44.12,48.33,51.97,54.79,56.72,57.80,
358.57,58.99,59.18,59.29,59.34,59.353,59.356/
DATA
4.76,35.80,98.85,11.87,40.86,54.81,94.74,15.64,83.56,86.47,34.39,56
5.33,46.28,34.22,31.18,56.16,55/
DATA
6.-110.86,-121.3,-89.04,-74.22,-58.56,-43.43,-30.07,-20.56,-11.13,
7-4.27,1.17,5.54,10.83,14.29,16.36/
T=TEMP
IF(T.LT.24.845) T=24.845
IF(T.GE.59.356) T=59.356
DO 184 I=2,19
IF(T-TF(I)) 182,101,184
181 ML=TL(I)

```

```

      HG=TG(I)
      TSATH=R(I)
      RETURN
102 D=TF(I)-TF(I-1)
      TTR=TF(I)-T
      TTR=T-TF(I-1)
      HL=(TL(I)*TTR+TL(I-1)*TTR)/D
      HG=(TG(I)*TTR+TG(I-1)*TTR)/D
      TSATH=(R(I)*TTR+R(I-1)*TTR)/D
      RETURN
104 CONTINUE
      END

```

```

      HG=TG(I)
      TSATH=R(I)
      RETURN
102 D=TF(I)-TF(I-1)
      TTR=TF(I)-T
      TTR=T-TF(I-1)
      HL=(TL(I)*TTR+TL(I-1)*TTR)/D
      HG=(TG(I)*TTR+TG(I-1)*TTR)/D
      TSATH=(R(I)*TTR+R(I-1)*TTR)/D
      RETURN
104 CONTINUE
      END

```

```

      HG=TG(I)
      TSATH=R(I)
      RETURN
102 D=TF(I)-TF(I-1)
      TTR=TF(I)-T
      TTR=T-TF(I-1)
      HL=(TL(I)*TTR+TL(I-1)*TTR)/D
      HG=(TG(I)*TTR+TG(I-1)*TTR)/D
      TSATH=(R(I)*TTR+R(I-1)*TTR)/D
      RETURN
104 CONTINUE
      END

```

85

```

P=PRES
IF(P.LT.1.0) P=1.0
M=ENTH
IF(M.GE.2500.0) M=24999.99999
Q=1.0
IF(M.LT.42.65) GO TO 10
IF(M.GE.170.61) GO TO 1
M=6
GO TO 2
1 IF(M.GE.426.53) GO TO 3
M=3
2 IF(P.LT.881.76) M=M+1
GO TO 15
3 IF(M.GE.1000.0) GO TO 4
M=2
IF(P.GE.1500.0) M=13
GO TO 20
4 IF(M.GE.10000.0) GO TO 5
M=1
GO TO 20
5 IF(P.LE.200.0) GO TO 6
M=10
N1=14
GO TO 20
6 IF(P.LE.11.0) GO TO 7
M=11
N1=15
GO TO 20
7 M=12
N1=16
GO TO 20
10 IF(P.LT.507.04) GO TO 11
M=5
GO TO 15
11 IF(M.GE.-53.36) GO TO 12
M=8
GO TO 15
12 M=9
GO TO 15
15 IF(M.GT.87.55) GO TO 20
I=PR=P/507.04
IF(I.GT.0) I=0
F=PR-I
FP=1.0-F
MS=FP*SH(I+1)+F*SH(I+2)
TQ=FP*TS(I+1)+F*TS(I+2)
IF(M.LT.MS) GO TO 17
IF(P.GT.107.586) GO TO 20
IF(P.LT.1.821) GO TO 105
DO 104 I=2,19
IF(P-R(I))/102,181,104
101 ML=TL(I)
MG=TC(I)
TQ=TF(I)
GO TO 106
102 D=R(I)-R(I-1)
PR=R(I)-P
PPR=P-R(I-1)
ML=(TL(I)+PPR+TL(I-1)+PPR)/D

```

```

0.67,46.69,21.70,52.71,49.0,56.25,62.01,66.36,69.49,71.82,73.47,74
9.33,2825,2816,2810,4043,4051,4045,4991,5132,5153,2819,
DATA/D/2815,2814,3321,3327,3327,3766,3807,3813,4119,4243,
1,4264,4374,4617,4665,4561,4928,5010,2813,2821,2818,3294,
2,3318,3323,3663,3759,3780,3908,4110,4163,4079,4376,4463,
3,4209,4581,4697,180,2,181,6,179,6,176,11250,5,250,7,248,9,245,9
4,316,3,314,9,312,5,309,3,304,7,382,378,7,374,8,456,6,452,7,448,5,
5,444,15,4,526,7,521,9,517,2,4991,5131,5151,5664,5963,6043,4
6560, 9,5010,4706,5186,5301,4826,5402,5549,5928,5587,5
7869, 3,4561,4698,4318,4746,4887,4405,4883,5044,4480,5
8000,5178,
P=PRES
IF(P.LT.1.0) P=1.0
M=ENTH
IF(M.GE.2500.0) M=24999.9999
Q=1.0
IF(M.LT.42.65) GO TO 10
IF(M.GE.170.61) GO TO 1
M=6
GO TO 2
1 IF(M.GE.426.53) GO TO 3
M=3
2 IF(P.LT.881.76) M=M+1
GO TO 15
3 IF(M.GE.1000.0) GO TO 4
M=2
IF(P.GE.1500.0) M=13
GO TO 20
4 IF(M.GE.10000.0) GO TO 5
M=1
GO TO 20
5 IF(P.LE.200.0) GO TO 6
N1=14
N=10
GO TO 20
6 IF(P.LE.11.0) GO TO 7
N=11
GO TO 20
7 N=12
GO TO 20
N1=16
GO TO 20
10 IF(P.LT.507.04) GO TO 11
M=5
GO TO 15
11 IF(M.GE.-53.32) GO TO 12
M=8
GO TO 15
12 M=9
GO TO 15
15 IF(M.GT.87.55) GO TO 20
PR=P/507.04
I=PR
IF(I.GT.0) I=0
FI=I
F=PR-FI
FP=1.0-F
MS=FP*SH(I+1)+F*SH(I+2)
TQ=FP*TS(I+1)+F*TS(I+2)

```

```

HG=(TG(I)*PPR+TG(I-1)*PPR)/D
TQ=(TF(I)*PPR+TF(I-1)*PPR)/D
GO TO 186
184 CONTINUE
185 ML=-132.8
HG=68.31
TQ=24.84
Q=0.8
GO TO 28
16 IF(M.GT.MG) GO TO 28
Q=(M-ML)/(MG-ML)
GO TO 38
17 Q=(M-MS)/(0.8026886*P+25.021)
GO TO 38
28 IF(M.LE.20080.) NI=M
FP=(P-BP(N))/DP(N)
IP=FP
IF(I.P.GT.MX(N)) IP=MX(N)
F=FP-FI
FHS=(M-BH(N1))/DH(N)
IH=FM
FI=IH
FH=FI
FH=1.0-FH
I=IH*JP(N)+IP*LOC(N1)
J=I+JP(N)
TQ=FP*FH*(I)+F*FH*(I+1)+FP*FF*(J)+F*FF*(J+1)
30 QUAL=Q
PHTEMP=TQ
RETURN
END

```

```

FUNCTION PHDENS(PRES,ENTH)
COMMON /PHDENS1/R(1612)
DIMENSION PD(19),HL(19),HG(19),RL(19),RG(19),MS(11),RS(11),LOC(19)
1,JP(16),DP(16),DH(16),BP(16),BH(19),MX(16)
DIMENSION AA( 85),AB(110),AC(107),AD(113),AE(119),AF( 7A)
EQUIVALENCE( R,AA), ( R( 86),AB), ( R( 196),AC), ( R( 303),AD)

```

```

IF(M.LT.MS) GO TO 17
IF(P.GT.187.586) GO TO 20
IF(P.LT.1.021) GO TO 105
DO 104 I=2,19
IF(P-R(I))*102,101,104
101 ML=TL(I)
HG=TG(I)
TQ=TF(I)
GO TO 106
102 D=R(I)-R(I-1)
PPR=R(I)-P
PPRP=R(I-1)
ML=(TL(I)*PPR+TL(I-1)*PPR)/D
HG=(TG(I)*PPR+TG(I-1)*PPR)/D
TQ=(TF(I)*PPR+TF(I-1)*PPR)/D
GO TO 106
104 CONTINUE
105 ML=-132.8
HG=68.31
TQ=24.84
Q=0.8
GO TO 28
16 IF(M.GT.MG) GO TO 20
Q=(M-ML)/(MG-ML)
GO TO 38
17 Q=(M-MS)/(0.8026886*P+25.021)
GO TO 38
20 IF(M.LE.20080.) NI=M
FP=(P-BP(N))/DP(N)
IP=FP
IF(I.P.GT.MX(N)) IP=MX(N)
FI=IP
F=FP-FI
FHS=(M-BH(N1))/DH(N)
IH=FM
FI=IH
FH=FI
FH=1.0-FH
I=IH*JP(N)+IP*LOC(N1)
J=I+JP(N)
TQ=FP*FH*(I)+F*FH*(I+1)+FP*FF*(J)+F*FF*(J+1)
30 QUAL=Q
PHTEMP=TQ
RETURN
END

```

```

FUNCTION PHDENS(PRES,ENTH)
DIMENSION PD(19),HL(19),HG(19),RL(19),RG(19),MS(11),RS(11),LOC(19)
1,JP(16),DP(16),DH(16),BP(16),BH(19),MX(16),R(612)
DIMENSION AA( 85),AB(110),AC(107),AD(113),AE(119),AF( 7A)
EQUIVALENCE( R,AA), ( R( 86),AB), ( R( 196),AC), ( R( 303),AD)

```



```

M=ENTH
IF(M.LT.425.0)GO TO 9
IF(M.LT.5000.0)GO TO 5
IF(M.LT.10000.0)GO TO 3
IF(M.GE.25000.0) M=24999.9999
IF(P.LT.100.0)GO TO 1
N=1
GO TO 33
1 IF(P.LT.10.0)GO TO 2
N=2
GO TO 33
2 IF(P.LT.100.0)GO TO 4
N=3
GO TO 33
3 IF(P.LT.1000.0)GO TO 6
N=4
GO TO 33
4 IF(P.LT.10000.0)GO TO 8
N=5
GO TO 33
5 IF(P.LT.100000.0)GO TO 11
N=6
GO TO 33
6 IF(P.LT.1000000.0)GO TO 14
N=7
GO TO 33
7 IF(P.LT.10000000.0)GO TO 17
N=8
GO TO 33
8 IF(P.LT.100000000.0)GO TO 20
N=9
GO TO 33
9 IF(M.LT.90.0)GO TO 16
IF(M.LT.600.0)GO TO 12
IF(M.LT.1500.0)GO TO 11
N=2
GO TO 33
11 N=11
GO TO 33
12 IF(M.LT.250)GO TO 13
N=13
GO TO 33
13 IF(P.LT.300.0)GO TO 14
N=14
GO TO 33
14 IF(M.LT.160.0)GO TO 15
N=15
GO TO 33
15 N=16
GO TO 33
16 PR=P/500.8
I=PR
IF(I.GT.9)I=9
F=PR-I
FP=1.8-F
MSOL=FP*MS(I+1)+F*MS(I+2)
IF(M.LT.MSOL) M=MSOL
PHOENS=FP*RS(I+1)+F*RS(I+2)

```

```

DATAAD/3.433,3.879,1.039,1.861,2.507,3.031,3.471,5.248,5.452,5.713
1.0,4.657,4.895,5.106,5.295,5.479,4.361,4.6,4.81,3.83,4.116
2.4,3542.875,3.314,3.644,3.915,2.318,2.621,3.196,3.498,1.864,2.389
3.2,789,3.112,1.521,2.032,2.437,2.771,1.271,1.742,1.2,4.73,1.086,
4.1,523,1.897,2.222,9.881,1.348,1.7,2.012,8.427,1.209,1.54,1.837,76
508,1.099,1.409,1.691,6.956,1.01,1.301,1.569,6.37,9.304,1.19,1.433,
64.576,4.676,4.771,4.861,4.944,5.023,5.098,3.849,3.981,4.106,4.222,
74.326,4.423,4.513,3.3,3.176,3.359,3.536,3.685,3.815,3.932,0.2,0.22,
82.433,2.756,2.986,3.171,3.328,0.1,1.83,3.618,3.543,7.003,8.596,1.0
912.0,1.1615,3.196,4.733,6.222,7.662,9.052,0.1,1.45,2.87,4.258/
DATAAE/5611,6927,8203,0.1319,2614,3884,5125,6337,7518,0.
1,1213,2407,3581,4731,5856,6956,0.1129,2231,3332,4395,5
2458,6443,7416,3.346,3.499,3.632,2.554,2.806,3.007,3.176,3.98,2.1
387,2.528,2.728,1.529,1.843,2.1,2.318,1.201,1.494,1.747,1.967,9.702
4,1.233,1.469,1.68,8.079,1.04,1.258,1.451,6.9,8.957,1.09,1.271,6.02
51.7862,9614,1.127,5343,7003,8596,1.012,0.1,1.437,2.849,4.226,
65558,6843,8079,0.1211,2.402,3.571,4.711,5.822,6.9,0.1,1046,20
779,3094,4091,5067,6021,0.0917,1.834,2.726,3.618,4.481,5.343,
80,0.0,2.115,2.433,2.595,2.756,0.0,0.1,1.685,1.95,2.18,2.355,0.
9,0.0,1.271,1.562,1.793,1.984,0.3859,1.123,997,1.259,1.477/
DATAAF/1.665,0.2866,5559,8065,1.029,1.228,1.407,0.23,4519,
2642,3252,4812,6311,774,9101,0.1437,2.849,4.226,5558,6843,
3.8079,0.03397,0.3644,1.078,0.3364,0.3395,1.03159,0.3194,0.9375
4,0.02785,0.3027,0.8839,1.47E-5,0.01897,0.03751,1.708E-5,0.0179,0.0
5353,1.843E-5,0.01703,0.03351,1.875E-5,0.0183,0.036,1.925E-6,0.0019
686,0.003912,2.013E-6,0.001936,0.003009,2.075E-6,0.001891,0.003716,
71.363E-6,0.00185,0.003632,2.15E-6,0.001812,0.003554,2.2E-6,0.00177
86,0.003482/
P=PRES
IF(P.LT.1.0) P=1.0
M=ENTH
IF(M.LT.425.0)GO TO 9
IF(M.LT.5000.0)GO TO 5
IF(M.LT.10000.0)GO TO 3
IF(M.GE.25000.0) M=24999.9999
IF(P.LT.100.0)GO TO 1
N=1
GO TO 33
1 IF(P.LT.10.0)GO TO 2
N=2
GO TO 33
2 IF(P.LT.100.0)GO TO 4
N=3
GO TO 33
3 IF(P.LT.100.0)GO TO 6
N=4
GO TO 33
4 IF(P.LT.1000.0)GO TO 8
N=5
GO TO 33
5 IF(M.LT.1800.0)GO TO 7
IF(P.LT.300.0)GO TO 6
N=6
GO TO 33
6 N=7
GO TO 33

```



```

IF(M.EQ.MSOL) RETURN
IF(P.GE.600.0) GO TO 10
IF(M.LT.8.0) GO TO 10
IF(P.LT.300.0) GO TO 17
N=14
GO TO 33
17 N=16
GO TO 19
18 N=12
19 IF(P.GE.107.506) GO TO 33
DO 20 I=2,19
IF(P-PD(I)) 21,21,20
20 CONTINUE
21 D=PD(I)-PD(I-1)
DF=PD(I)-P
DB=P-PD(I-1)
MLIQ=(ML(I)*DB+ML(I-1)*DF)/D
HLIQ=(HL(I)*DB+HL(I-1)*DF)/D
IF(M.LE.HLIQ) GO TO 33
HGAS=(HG(I)*DB+HG(I-1)*DF)/D
IF(M.GE.HGAS) GO TO 33
RLIQ=(RL(I)*DB+RL(I-1)*DF)/D
PHDENS=RLIQ/((H-HLIQ)/(HGAS-HLIQ))
RETURN
33 IF(M.LE.20000.) N1=N
FP=(P-8P(N))/DP(N)

IF(M.EQ.MSOL) RETURN
IF(P.GE.600.0) GO TO 10
IF(M.LT.8.0) GO TO 10
IF(P.LT.300.0) GO TO 17
N=14
GO TO 33
17 N=16
GO TO 19
18 N=12
19 IF(P.GE.107.506) GO TO 33
DO 20 I=2,19
IF(P-PD(I)) 21,21,20
20 CONTINUE
21 D=PD(I)-PD(I-1)
DF=PD(I)-P
DB=P-PD(I-1)
MLIQ=(ML(I)*DB+ML(I-1)*DF)/D
IF(M.LE.HLIQ) GO TO 33
HGAS=(HG(I)*DB+HG(I-1)*DF)/D
IF(M.GE.HGAS) GO TO 33
RLIQ=(RL(I)*DB+RL(I-1)*DF)/D
PHDENS=RLIQ/((H-HLIQ)/(HGAS-HLIQ))
RETURN
33 IF(M.LE.20000.) N1=N
FP=(P-8P(N))/DP(N)

SUBROUTINE PHDATA
COMMON /PHDENSIT/R(612)
DATA((R(I), I=296,405))=2.700,3.411,3.954,4.393,1.352,2.206,2.093,3.4
133,3.879,1.039,1.061,2.507,3.031,3.471,5.248,5.452,5.713,0.4,0.57,
24.895,5.106,5.295,4.879,4.361,4.6,4.81,3.881,3.835,4.116,4.354,2.8
375,3.314,3.648,3.915,2.318,2.821,3.196,3.198,1.864,2.309,2.789,3.1
412,1.521,2.032,2.437,2.771,1.271,1.747,2.14,2.473,1.066,1.523,1.89
57,2.222,9481,1.348,1.7,2.012,0.427,1.209,1.54,1.837,1.768,1.099,1
6.489,1.691,6956,1.01,1.301,1.569,637,9304,1.19,1.433,4.576,4.67
76,4.771,4.861,4.944,5.023,5.098,3.849,3.981,4.108,4.222,4.326,4.42
83,4.513,3.3,3.176,3.359,3.536,3.685,3.835,3.932,0.2,0.22,2.433,2.75
96,2.966,3.171,3.328,0.1834,3.618,3.534,3.788,3.8596,1.012,0.1
DATA((R(I), I=406,520))=1.615,3.196,4.733,6.222,7.662,9.052,0.145,
1.287,4.258,5.611,6.927,8.203,0.1319,2.614,3.888,5.125,6.337,7.51
20.0,1.213,2.407,3.581,4.731,5.856,6.956,0.1129,2.231,3.332,4.39
35,5.459,6.443,3.16,3.346,3.499,3.632,2.554,2.806,3.007,3.176,1.984
4.2,287,2.528,2.728,1.529,1.843,2.12,3.18,1.201,1.494,1.747,1.967,
59782,1.233,1.469,1.66,8079,1.04,1.254,1.451,69.8957,1.091,271,

```

```

FUNCTION PHENTR(PRES,ENTH)
DIMENSION LOC(23),JP(20),
      ,RI(9),ML(19),MG(19),SL(19),SG(19),MS(10),SS(10),TS(10),
COMMON/ENTRPY/S(573)
DATA(S(1),I=1,108)=6.726,6.143,5.816,5.593,7.632,6.986,6.615,6.35
,9.317,7.649,7.26,6.978,8.925,8.168,7.755,7.755,8.568,7.719,7.205,6
.998,6.78,9.577,8.634,8.233,7.926,7.691,10.29,9.388,8.928,8.613,8
.379,10.88,9.345,9.536,9.196,8.992,10.09,9.84,9.749,9.169,8.923,11
.06,10.83,10.40,10.16,9.914,12.60,11.53,11.19,10.18,6.33,23.12
.11,8.11,11.52,11.23,6.371,7.003,6.279,5.014,5.445,9.707,8.295,7.5
58,7.095,6.721,10.68,9.268,8.53,8.072,7.726,11.47,10.05,9.32,8.868
,9.525,12.12,10.71,9.979,9.352,9.12,8.671,11.26,10.58,10.1,9.773,10
.83,9.26,8.985,8.108,11.97,18.6,9.916,9.512,12.95,11.59,10.89,10
.49,13.74,12.37,11.68,11.28,14.39,13.02,12.33,11.93,14.9,13.57)
DATA(S(1),I=109,216)=12.08,12.48,15.6,12.1,11.13,10.63,10.3,15.95
,13.58,12.47,11.97,11.64,11.92,14.54,13.5,12.95,12.62,18.71,15.32
,14.24,13.73,13.4,19.36,15.97,14.89,14.38,14.85,19.31,16.56,15.44
,11.95,14.6,12.98,11.55,11.83,10.39,14.4,14.3,12.29,11.87,15.38,13.9
,9.13,29.12,8.7,16.14,17.6,14.06,13.64,15.23,13.06,13.7,12.77,16.6
,15.29,4.63,14.21,14.76,16.28,16.59,15.19,18.11,7.84,16.36,15.9
,5.28,21.16,8.11,5.73,15.22,14.09,21.7,18.25,17.16,65.16,33.22,68
.19,23.18,15.17,64.17,31.23,44.19,99.18,9.18,4.18,87.16,1,17.76,1
.44,4.08,13.64,17.77,16.39,15.73,15.29,18.89,17.52,16.87,16.42,19.76,1
.84,17.1,7.38,32.10,9.18,25.17,85.20,92.19,55.18,86.18,46)
DATA(RI=1,82,2,0,8,0,10,4,25,0,3,0,6,9,0,9,0,28,0,15,1,0,
,176,8,182,0,105,8,106,5,187,25,187,65,75,187,506)
DATA(MG=68,31,65,11,78,59,76,35,88,88,85,11,87,48,66,54,81,94,
,74,15,64,83,56,86,47,39,35,56,37,46,28,39,22,33,18,66,16,55)
DATA(ML=132,8,-159,13,-124,25,-117,79,-118,86,-181,3,-89,84,
,77,4,22,-58,58,-43,3,-30,07,-28,56,-11,13,-44,27,1.17,5.54,10.83,
,44,29,16,36)
DATA(SS=0,961,0,598,8,838,7,567,7,198,6,796,6,401,6,022,5,680,
,5,375,5,117,4,938,8,782,4,596,4,485,5,397,4,312,4,253,3,195)
DATA(SL=1,85,1,32,1,43,1,0,93,1,886,2,126,2,98,2,632,2,97,
,3,229,3,444,3,595,3,744,3,858,3,942,4,815,4,889,4,154,4,195)
DATA(MS=-132,0,-109,96,-67,59,-65,71,-44,27,-23,18,-2,45,18,06,
,18,32,59,50)

```

9

```

FUNCTION PHENTR(PRES,ENTH)
  DIMENSION LOC(23),JP(20),S(573),DP(20),DH(20),BP(20),BH(23),MX(20)
  1,R(19),HL(19),HG(19),SL(19),SG(19),MS(10),SS(10)
  DIMENSION AL(10),AB(11),AC(11),AD(11),AE(11),AF( 7)
  EQUIVALENCE( S,AA),( S( 11),AB),( S( 222),AC),( S( 337),AD)
  1, ( S( 456),AE),( S( 567),AF)
  DATA R/1.022,2.0,4.0,6.0,14.0,25.0,43.0,69.0,99.0,128.0,151.0,
  165.0,176.0,182.0,185.0,186.5,187.25,187.68875,187.506/,
  DATA HG/60.331,65.11,70.59,76.35,80.98,85.11,87.40,86.54,81.94,
  117.4,15.64,83.56,86.47,34.39,35.36,33.46,28.34,22.31,10.66,16.55/,
  DATA HL/-132.0,-129.13,-124.25,-117.79,-110.86,-101.3,-89.04,
  1-74.22,-58.58,-43.43,-30.07,-20.56,-11.13,-4.27,-17.54,10.83,
  214.29,16.36/,
  DATA SG/8.96,18.0,508.6,0.038,7.567,7.190,6.796,6.401,6.02,5.680,
  1.375,5.511,4.930,4.742,4.596,4.405,4.397,4.312,4.253,4.195/,
  DATA SL/1.105,1.322,1.491,1.693,1.886,2.126,2.398,2.692,2.974,
  33.229,3.446,3.595,3.744,3.858,3.942,4.015,4.089,4.154,4.195/,
  DATA HS/-132.0,-109.96,-87.59,-65.71,-44.27,-23.18,-2.45,10.06,
  136.32,50.50/,
  DATA SS/1.105,1.207,1.229,1.249,1.267,1.284,1.299,1.315,1.331,
  11.347/,
  DATA LOC/309.1,17,37,57,87,111, 0,141,157,173,193,217,241,271,
  303,42,457,469,504,534,456,558/,
  DATA JP/11,4,5,5,5,5,5,0,4,4,5,4,4,5,8,11,3,3,7,6/,
  DATA MX/3,2,3,3,3,2,3,0,2,2,3,2,3,6,9,1,1,5,4/,
  DATA BP/800.,150.,20.,2. 0., 0.,5,0,0,0,0,0,-5,0,0,-5,.,
  DATA BH/87,84,0,293,92,0,0.,
  DATA DH/170,0,170,0,170,0,170,0,425,0,425,0,425,0,2000,0,
  2000,0,2000,0,5000,0,5000,0,5000,0,60,0,-110,0,-137,0,42.65,42.65,
  42.65,2000.,2000.,20000./,
  DATA DP/900.,150.,30.,3,1000.,100.,10,0.,1000.,100.,10,1000.,
  100.,10.,587.84,440.88,293.92,420.44,29.392,2.9392/,
  DATA DH/85.3,85.3,85.3,85.3,275.0,275.0,275.0,275.0,1000.0,1000.0,
  1,1000.0,3000.0,3000.0,3000.0,37.0,17.0,10.0,31.99,31.99,31.99/,
  DATA AA/676.726,6.153,5.815,5.583,7.632,6.986,6.615,6.35,8.317,7.649,
  7.26,6.976,6.925,8.108,7.755,7.55,8.568,7.719,7.698,6.998,6.78,5,
  777.8,684.8,231.7,92.6,1691.10,259.388,8.928,8.619,8.379,10.08,9.9

```

[illegible]

```

N=18
GO TO 33
15 IF(P.LE.18.0) GO TO 16
N=19
GO TO 20
16 N=20
20 IF(P.GT.187.506) GO TO 27
DO 24 I=2,19
IF(P-R(I))22,21,24
21 HLIQ=HL(I)
HGAS=HG(I)
SLIQ=SL(I)
SGAS=SG(I)
GO TO 25
22 D=R(I)-R(I-1)
PPR=R(I)-P
PPR=P-R(I-1)
HLIQ=(HL(I)*PPR+HL(I-1)*PPR)/D
HGAS=(HG(I)*PPR+HG(I-1)*PPR)/D
SLIQ=(SL(I)*PPR+SL(I-1)*PPR)/D
SGAS=(SG(I)*PPR+SG(I-1)*PPR)/D
GO TO 25
24 CONTINUE
25 IF(H.GT.HGAS) GO TO 27
IF(H.LT.HLIQ) GO TO 27
PHENTR=(H-HLIQ)/(HGAS-HLIQ)*(SGAS-SLIQ)+SLIQ
RETURN

SUBROUTINE DATAENTR
COMMON/ENTRYP/5(573)
DATA((S(I),I=217,328)=18.41,17.04,16.36,15.95,20.04,18.67,17.99,17.15,21.16,19.79,19.11,18.71,22.03,20.66,19.98,19.58,22.62,21.23,20.25,20.14,23.2,21.82,21.14,20.74,23.44,19.99,18.91,18.41,18.07,25.307,21.62,20.54,20.04,19.7,26.2,22.74,21.66,21.16,20.83,27.08,23.62)

N=18
GO TO 33
2 IF(P.LE.17.0) GO TO 3
N=3
GO TO 33
3 N=4
GO TO 33
4 IF(H.GE.1800.0) GO TO 8
N=5
GO TO 9
8 IF(H.GE.5000.0) GO TO 10
N=9
GO TO 10
9 IF(P.LE.375.0) N=N+1
IF(P.LE.40.0) N=N+1
GO TO 33
10 N=12
N1=21
IF(H.GE.25000.0) H=24999.9999
IF(P.LE.375.0)N1=N1+1
IF(P.LE.40.0)N1=N1+1
GO TO 9
11 IF(P.LE.800.0) GO TO 13
IF(H.LE.60.0) GO TO 12
N=15
GO TO 33
12 N=16
GO TO 27
13 IF(H.GE.43.0) GO TO 14
IF(P.GE.587.84) GO TO 12
N=17
GO TO 20
14 IF(P.LE.191.0) GO TO 15
N=18
GO TO 33
15 IF(P.LE.18.0) GO TO 16
N=19
GO TO 20
16 N=20
20 IF(P.GT.187.506) GO TO 27
DO 24 I=2,19
IF(P-R(I))22,21,24
21 HLIQ=HL(I)
HGAS=HG(I)
SLIQ=SL(I)
SGAS=SG(I)
GO TO 25
22 D=R(I)-R(I-1)
PPR=R(I)-P
PPR=P-R(I-1)
HLIQ=(HL(I)*PPR+HL(I-1)*PPR)/D
HGAS=(HG(I)*PPR+HG(I-1)*PPR)/D
SLIQ=(SL(I)*PPR+SL(I-1)*PPR)/D
SGAS=(SG(I)*PPR+SG(I-1)*PPR)/D
GO TO 25
24 CONTINUE
25 IF(H.GT.HGAS) GO TO 27
IF(H.LT.HLIQ) GO TO 27
PHENTR=(H-HLIQ)/(HGAS-HLIQ)*(SGAS-SLIQ)+SLIQ
RETURN

```

```

4.22.53.22.03.21.7.27.07.24.25.23.14.22.62.22.29.28.5.24.05.23.72.2
53.2.22.07.4.094.3.69.3.24.3.011.2.604.2.35.1.994.1.609.4.526.4.112
6.3.772.3.465.3.166.2.073.2.575.2.272.4.921.4.491.4.153.3.056.3.577
7.3.31.3.0432.773.5.303.4.836.4.509.4.207.3.942.3.088.3.441.3.192.
8.1.219.607.192.0.0.0.5.355.4.686.4.218.3.814.3.435.1.74.1.229.
9.744.264.0.0.16.094.5.376.4.91.4.53.4.189.2.16.1.735.1.26.795.
DATA(S(I),I)=329.445)=.328.0.6.788.5.955.5.49.5.12.4.796.2.518.2.
1136.1.739.1.295.852.41.7.262.6.496.6.5.63.5.297.2.837.2.479.2.1
225.1.751.334.918.405.0.0.0.0.3.128.2.783.2.453.2.12.1.763.1
3.376.972.55.0.0.0.3.398.3.058.2.745.2.437.2.122.1.789.1.421.1
4.833.62.0.0.3.652.3.313.3.01.2.718.2.429.2.131.1.814.1.465.1.091
5.687.0.0.3.894.3.55.3.253.2.973.2.7.2.427.2.142.1.841.1.511.1.152.
6.765.4.126.3.773.3.478.3.208.2.968.2.69.2.428.2.158.1.871.1.557.1.2
716.348.3.993.3.59.3.428.3.176.2.929.2.684.2.434.2.172.1.897.1.160
8.1.039.6495.26.1.666.1.286.931.2.16.1.843.1.507.2.576.2.283.1.
9997.2.945.2.664.2.397.3.286.3.004.2.747.3.615.3.319.3.062.3.939.
DATA(S(I),I)=446.554)=3.616.3.352.4.268.3.904.3.624.4.62.4.183.3.8
161.4.979.4.458.4.126.4.465.4.191.3.993.4.953.4.613.4.394.5.409.5.0
208.4.765.5.631.5.375.5.189.6.214.5.716.5.429.0.4.803.4.712.4.633.
37.389.6.436.5.895.5.619.5.436.5.305.5.176.0.168.7.143.6.547.6.223.
46.005.5.843.5.467.9.81.7.47.107.6.752.6.509.6.326.6.138.9.321.8.
522.7.576.7.204.6.947.6.751.6.548.8.87.371.6.738.6.499.0.0.9.90
56.8.456.7.798.7.502.7.236.7.034.10.83.9.310.8.646.8.258.7.985.7.77
76.11.49.9.959.9.283.8.888.8.611.8.396.12.82.10.47.9.789.9.393.9.11
83.8.896.20.97.19.57.18.89.10.49.12.174.20.29.19.91.19.55.22.76.21.8
9.21.16.20.55.23.26.21.82.21.14.20.74.24.26.22.61.21.91.21.5.24.61.
DATA(S(I),I)=555.573)=23.17.22.07.22.6.28.44.24.85.23.72.23.2.22.0
17.29.07.25.46.24.35.23.85.23.68.29.67.26.09.25.22.24.68.24.25.0.)
END

```

```

FUNCTION PHCOND(PRES,ENTH)
COMMON/PHLAMB/C(735)
DIMENSION LOC(19),JP(19),DP(19),DH(19),BP(19),BH(19),MX(19),
1PL(19),HL(19),HG(19),CL(19),CG(19),HS(11)
DATA(LOC=1,29,50,86,149,173,191,269,339,375,407,461,493,517,529,
1583,577,601,661)
DATA(JP=4,3,4,7,4,3,6,7,6,6,4,4,2,3,3,4,5)
DATA(MX=2,1,2,5,2,1,4,5,4,2,2,0,1,1,1,2,3)
DATA(BP=0,0,0,490,132,305,500,1000,2006,0,0,20,500,2000,,
10,0,0,0,0,0,1.)
DATA(DP=160,250,170,28.65,250,200,500,100,160,300,1000,
1500,3000,1500,300,40,10,1.)
DATA(BH=-135,-105,-115,-45,-45,-75,-95,-60,70,145,25,,
175,425,1800,11000,11000,11000,11000,11000.)
DATA(DH=5,10,5,15,23,20,10,15,15,40,50,275,180,,
12000,2000,2000,1000,1000.)
DATA(PL=1.02,2.4,8.14,25.43,69.99,128.151,165.176,162
1.185,186.5,187.25,187.46875,187.51)
DATA(HL=-132.8,-129.13,-124.25,-117.79,-110.86,-101.3,-89.04,
1-74.22,-56.58,-43.43,-30.07,-20.56,-11.13,-4.27,1.17,5.54,10.83,
214.29,16.36)
DATA(HG=60,31,65,11,70,59,76,35,80,98,85,11,87,40,86,54,81,94,
174.15,64.83,56.86,47.34,39.56,33.46,28.34,22.31,18.66,16.55)

```

27 PR=P/587.04

```

I=PR
IF(I.GT.8) I=8
FI=I
F=PR-FI
FP=1.0-F
MSOL=FP*HS(I+1)+F*HS(I+2)
IF(M.GT.MSOL) GO TO 33
PHENTR=FP*SS(I+1)+F*SS(I+2)
RETURN
33 IF(M.LE.20000.)NI=M

```

```

IP=(P-BP(N))/DP(N)
IP=FP
IF(IP.GT.MX(N)) IP=MX(N)
FI=IP
F=FP-FI
FM=FM-SH(M1))/DH(N)
FI=FM
FF=FM-FI
FM=1.0-FF
I=FM*JP(N)+IP*LOC(N1)
J=I+JP(N)
PHENTR=FP*FH*S(I)+F*FH*S(I+1)+FP*FF*S(J)+F*FF*S(J+1)
RETURN
END

```

```

FUNCTION PHCOND(PRES,ENTH)
DIMENSION LOC(19),JP(19),DP(19),DH(19),BP(19),BH(19),MX(19),
1PL(19),HL(19),HG(19),CL(19),CG(19),HS(11),C(735)
DIMENSION AA(10),AB(109),AC(107),AD(96),AE(96),AF(112),AG(111)
EQUIVALENCE(C,AA),(C(105),AB),(C(214),AC),(C(321),AD)
1 (C(417),AE),(C(513),AF),(C(625),AG)
DATA(AA=.0381,0.0,0.0,0.4705,0.0394,0.0,0.05265,0.4741,0.0394,0.0
1,0549,0.0533,0.4761,0.4132,0.05608,0.05629,0.05417,0.04816,0.05713,0.057
273,0.05756,0.05492,0.05781,0.05918,0.05928,0.05871,0.058,0.05926,0.05848,0
35795,0.06169,0.06273,0.05648,0.06196,0.06522,0.05419,0.06097,0.06571,0.0512
45,0.05922,0.06503,0.4787,0.05698,0.05368,0.0457,0.05422,0.06172,0.0478,0.04
51,0.0,0.05464,0.0479,0.04,0.0586,0.05493,0.048,0.04,0.0607,0.05948,0.05
6504,0.0483,0.06275,0.06196,0.06323,0.0553,0.06427,0.06426,0.06311,0.06084,,
706514,0.0608,0.06563,0.06414,0.06553,0.06715,0.06769,0.06688,0.06556,0.067
873,0.06859,0.06919,1.311,449,1.591,1.509,1.42,1.326,1.227,1.17,1.18
96,1.186,1.181,1.18,1.187,1.196,907,1.133,9271,9487,1.018/
DATA(AB=1.105,1.201,0.15,1.11,0.8018,8992,1.049,1.219,0.30,3.3,
1.6988,0.6161,1.016,1.248,0.15,2.508,9377,9202,1.018,1.158,2.12,
22,1.034,8993,9015,95,1.02,85,8424,832,8356,8431,8864,87
34,57,696,8216,8203,8046,7785,744,0.05609,0.05812,0.05998,0.0617
44,0.0504,0.0502,0.0521,0.05625,0.04754,0.04834,0.04985,0.0515,0.04554,0.04
5504,0.0462,0.0477,0.0487,0.04129,0.04264,0.04427,0.03503,0.03708,0.03906,
6.04099,0.6571,0.6873,0.6954,0.6368,0.6884,0.7263,0.05938,0.0656,0.070

```

95

[illegible]

```

GO TO 22
5 N=7
GO TO 22
6 IF(M.LT.-45.) GO TO 11
IF(M.GE.70.) GO TO 9
IF(P.LT.300.) GO TO 7
N=5
GO TO 33
7 N=4
R=M-16.455
IF(R.LT.0.) R=-R
IF(P.LT.187.51) GO TO 8
R=1.0/(3.1136694+.211577*(P-187.51)+.4487232*R-.004707536*R*
1(P-187.51))
GO TO 33
8 R=1.0/(3.1136694-.211577*(P-187.51)+.4487232*R+.004707536*R*
1(P-187.51))
GO TO 17
9 IF(M.GE.145.) GO TO 10
N=9
IF(P.GE.140.) GO TO 33
IF(M.GE.80.) GO TO 33
GO TO 17
10 N=18
GO TO 33
11 IF(M.LT.-105.) GO TO 21
N=2
IF(P.LT.125.) GO TO 17
GO TO 33
12 IF(M.LT.11000.) GO TO 26
IF(P.GE.80.) GO TO 15
IF(P.GE.30.) GO TO 14
IF(P.GE.5.) GO TO 13
N=19
GO TO 33
13 N=18
GO TO 33
14 N=17
GO TO 33
15 IF(P.GE.380.) GO TO 16
N=16
GO TO 33
16 N=15
GO TO 33
17 DO 18 I=2,18
IF(P-PL(I))19,19,18
18 CONTINUE
19 D=PL(I)-PL(I-1)
D=P-PL(I)-P
D=P-PL(I-1)
MCA5=(M(I)*DB+M(I-1)*DF)/D
IF(M.GE.MCA5) GO TO 33
MLIQ=(M(I)*DB+M(I-1)*DF)/D
IF(M.LE.MLIQ) GO TO 33
CLIQ=(C(I)*DB+C(I-1)*DF)/D
PWCND=((C(I)*DB+C(I-1)*DF)/D-CLIQ)/(M-MLIQ)/(MCA5-MLIQ)+CLIQ
RETURN
21 N=1

```

```

IF(M-LE,-132.82+0.04*P)) GO TO 22
IF(P-LT.23.) GO TO 17
GO TO 33
22 PR=P/500.0
I=PR
IF(I-CT.9) I=9
F=PR-I
MSOL=F*MS(I+2)+(1.0-F)*MS(I+1)
IF(M-LT.MSOL) M=MSOL
GO TO 33
26 IF(M-LT.1800.) GO TO 27
M=14
GO TO 33
27 M=13
33 FP=(P-BP(N))/DP(N)
END

SUBROUTINE PHLAMBDA
COMMON/PHLAMB/C(1735)
DATA(C(1),I=334,407)=.0963,.0969,.0903,.0828,.0753,.08305,.08974
1.09533,1.1001,0.945,.07336,.08093,.08781,.09403,.09945,.1036,.1
2033,.0713,.07895,.08575,.09216,.09803,.1031,.107,.00773,.0246,.031
306,.03486,.038,.04099,.00868,.01861,.0267,.03109,.03576,.03907,.01
4017,.01785,.02462,.02986,.03397,.03744,.01172,.01798,.02373,.02861
5.03266,.03614,.01323,.01849,.0235,.02793,.03179,.03519,.01464,.01
6222,.02365,.0277,.0313,.03454,.01552,.02279,.02917,.03454,.01897,.
78246,.02952,.03406,.02246,.02685,.03098,.03496,.02599,.02978,.033
838,.03677,.02979,.03299,.03607,.03866,.03344,.03611,.03884,.04157,
9.03755,.04015,.04267,.04512,.04132,.04415,.04642,.04863,.04762)
DATA(C(1),I=408,500)=.05507,.0621,.06822,.07362,.0785,.0832,.048
138,.05505,.06081,.06631,.0713,.03547,.0438,.05041,.05603,.06101,.0
2562,.03404,.04154,.04788,.0533,.05009,.0624,.03436,.04161,.04733,
3.05233,.0568,.06085,.0373,.04295,.04741,.05196,.05613,.05996,.0399
41,.04492,.04963,.05394,.05791,.06155,.04423,.04872,.0529,.05679,.0
5603,.06381,.04863,.05261,.05637,.0599,.06123,.06386,.0713,.08575,
6.09803,.107,.08562,.07943,.0916,.103,.0624,.07492,.08587,.09652,.0
76089,.07245,.08259,.0918,.05996,.07184,.08047,.08901,.06155,.07192
8.04832,.08742,.06361,.07362,.08172,.08866,.06386,.0726,.08135,.09
9089,.04153,.04663,.05311,.05948,.06748,.07232,.07671,.08076)
DATA(C(1),I=501,600)=.09369,.06678,.08962,.09228,.09386,.09586,.0
1977,.09942,.1024,.1035,.1046,.1056,.1111,.1116,.112,.1124,.1111,.1
2337,.1738,.162,.2321,.211,.2897,.2874,.3485,.3488,.4245,.44829,
3.4042,.44883,.462,.4596,.5567,.533,.5257,.6947,.6289,.6094,.9021
4.7651,.7231,.1178,.9492,.8754,.1511,.1791,.068,.1875,.1446,.1295,
5.4058,.4031,.4023,.4097,.4711,.4662,.6434,.5689,.5488,.9153,.7269,
6.6728,.1305,.9621,.8564,.1772,.1268,.1102,.228,.1625,.142,.8022,.0

```



23

COMMON/PHMU/V(820)

270E-

END

DIMENSION LOC(22),JP(22),DP

11,7270



```

1 IF(P.LT.5.0) GO TO 2
  N=21
  GO TO 33
2 N=22
  GO TO 33
3 IF(M.LT.1000.0) GO TO 4
  N=4
  GO TO 33
4 N=5
  GO TO 33
34 IF(P.LT.5.0) GO TO 35
  N=2
  GO TO 33
35 N=3
  GO TO 33
5 IF(M.LT.200.0) GO TO 7
  IF(P.LT.1000.0) GO TO 6
  N=6
  GO TO 33
6 N=7
  GO TO 33
7 IF(P.LT.1000.0) GO TO 8
  N=8
  GO TO 33
8 N=20
  GO TO 33
9 IF(P.LT.3000.0) GO TO 13
  IF(P.LT.4000.0) GO TO 11
  IF(M.GE.60.) GO TO 10
  N=9
  GO TO 30
10 N=10
  GO TO 33
11 IF(M.GE.30.) GO TO 12
  N=11
  GO TO 30
12 N=12
  GO TO 33
13 IF(P.LT.1000.0) GO TO 16
  IF(M.LT.40.) GO TO 14
  N=13
  GO TO 33
14 IF(P.LT.2000.0) GO TO 16
  IF(M.GE.0.) GO TO 15
  N=14
  GO TO 30
15 N=15
  GO TO 33
16 IF(M.GE.-30.0) GO TO 17
  N=16
  IF(M.LT.-90.0 AND P.LT.1250.) N=23
  GO TO 30
17 N=17
  GO TO 33
18 IF(M.GE.-70.0) GO TO 19
  N=18
  IF(M.GT.(-1.2-82*0.04*P)) GO TO 22
  GO TO 30

```

```

19 IF (H.GE.-20.0) GO TO 20
N=19
GO TO 22
20 N=20
22 IF (P.GE.187.506) GO TO 33
DO 23 I=2,19
IF (P-PL(I))*24,24,23
23 CONTINUE
24 D=PL(I)-PL(I-1)
D8=P-PL(I-1)
MGAS=(MG(I)*D8+MG(I-1)*D)/D
IF (H.GE.-MGAS) GO TO 33
MLIQ=(HL(I)*D8+HL(I-1)*D)/D
IF (H.LE.-MLIQ) GO TO 33
VLIQ=(VL(I)*D8+VL(I-1)*D)/D
PHVISC=((VG(I)*D8+VG(I-1)*D)/D-VLIQ)*(H-MLIQ)/(MGAS-HLIQ)+VLIQ
RETURN
30 PR=P/50.0
I=PR
IF (I.GT.9) I=9
F=P-R-I
MSO=F*MS(I+2)+(1.0-F)*MS(I+1)
IF (H.LT.MSOL) H=MSOL
33 FP=(P-BP(N))/DP(N)
IP=FP
IF (IP.GT.MX(N)) IP=MX(N)
F=FP-IP
FF=1.0-F
FM=(H-BH(N))/DH(N)
IM=FM
FF=FM-IM
FM=1.0-FF
I=IM*JP(N)+IP*LOC(N)
J=I*JP(N)
PHVISC=FP*FM*(I+1)+F*FM*(I+1)+FP*FF*(J+1)+F*FF*(J+1)
RETURN
END

SUBROUTINE PHOTMU
COMMON/PHMU/V(1620)
DATA (V(I), I=332,401)=5.308E-11,6.347E-11,7.565E-11,3.233E-11,4.61E-11,4.874E-11,5.771E-11,6.786E-11,3.039E-11,3.787E-11,4.532E-11,25.323E-11,16.197E-11,1.827E-10,2.403E-10,0.0,0.1,573E-10,2.147E-10,3.102E-10,0.0,0.1,392E-10,1.821E-10,2.401E-10,0.0,0.1,250E-10,1.4581E-10,2.122E-10,2.750E-10,0.1,151E-10,1.409E-10,1.811E-10,2.378E-10,0.0,1.066E-10,1.270E-10,1.587E-10,2.098E-10,2.609E-10,1.001E-10,1.175E-10,1.422E-10,1.8E-10,2.409E-10,9.366E-11,1.091E-10,1.296E-10,1.159E-10,2.061E-10,8.892E-11,1.021E-10,1.195E-10,1.433E-10,1.7807E-10,8.419E-11,9.627E-11,1.113E-10,1.311E-10,1.59E-10,8.05E-11,99.122E-11,1.05E-10,1.214E-10,1.441E-10,7.688E-11,8.681E-11)
DATA (V(I), I=402,470)=9.860E-11,1.134E-10,1.325E-10,7.103E-11,7.9419E-11,8.928E-11,1.009E-10,1.152E-10,6.621E-11,7.36E-11,8.196E-11,92.159E-11,1.03E-10,6.216E-11,5.874E-11,7.605E-11,8.429E-11,9.376E-11,31.5,87E-11,6.492E-11,7.115E-11,7.882E-11,8.649E-11,1.496E-10,2.0954E-10,0.1,8E-10,2.41E-10,1.288E-10,1.818E-10,2.455E-10,1.139E-10,1.523E-10,1.496E-10,2.4095E-10,5.10,2.119E-10,2.993E-10,0.0,1.028E-10,1.32E-10,1.83E-10,2.446E-10,0

```

```

6.,9.401E-11,1.174E-10,1.544E-10,2.127E-10,3.6-10,8.754E-11,1.063E-
7.,9.1348E-10,1.831E-10,2.430E-10,8.108E-11,9.755E-11,1.205E-10,1.15
86E-10,2.131E-10,7.645E-11,9.049E-11,1.096E-10,1.372E-10,1.827E-10,
97.183E-11,8.457E-11,1.009E-10,1.233E-10,1.573E-10,6.831E-11)
DATA(V(1),I=471,541)=7.955E-11,9.376E-11,1.125E-10,1.392E-10,6.47
19E-11,7.522E-11,8.782E-11,1.039E-10,1.258E-10,6.19E-11,7.144E-11,8
2.277E-11,9.679E-11,1.151E-10,5.919E-11,6.809E-11,7.84E-11,9.085E-1
31,1.066E-10,5.461E-11,6.242E-11,7.12E-11,8.138E-11,9.366E-11,5.103
4E-11,5.776E-11,5.46E-11,7.412E-11,8.419E-11,4.746E-11,5.388E-11,6
5.075E-11,6.832E-11,7.600E-11,4.479E-11,5.055E-11,5.60E-11,6.355E-1
61,7.103E-11,4.213E-11,4.768E-11,5.343E-11,5.955E-11,6.621E-11,4.00
78E-11,4.517E-11,5.052E-11,5.613E-11,6.216E-11,3.803E-11,4.3E-11,4.
879E-11,5.333E-11,5.87E-11,1.153E-10,1.608E-10,1.999E-10,0.0,0.0.
90.0,1.005E-10,1.295E-10,1.69E-10,2.146E-10,0.0,0.0,0.0,0.0E-11)
DATA(V(1),I=542,610)=1.09E-10,1.379E-10,1.702E-10,2.365E-10,0.0
1.0,7.60E-11,9.499E-11,1.158E-10,1.484E-10,1.863E-10,2.795E-10,0.0
20.,7.15E-11,9.467E-11,1.007E-10,1.222E-10,1.55E-10,1.943E-10,2.307
3E-10,0.0,6.556E-11,7.668E-11,8.965E-11,1.063E-10,1.293E-10,1.637E-1
40E-10,1.721E-10,2.093E-10,5.625E-11,6.491E-11,7.439E-11,8.559E-11
53E-10,1.176E-10,1.428E-10,1.8E-10,5.246E-11,6.036E-11,6.879E-1
6,9.94E-11,1.176E-10,1.428E-10,1.8E-10,5.246E-11,6.036E-11,6.879E-
711,7.843E-11,1.8.995E-11,1.043E-10,1.232E-10,1.496E-10,4.908E-11,5.6
839E-11,6.405E-11,7.256E-11,8.241E-11,9.425E-11,1.091E-10,1.288E-10
9.46E-11,5.289E-11,5.996E-11,6.762E-11,7.624E-11,8.632E-11)
DATA(V(1),I=611,670)=9.852E-11,1.139E-10,4.319E-11,4.975E-11,5.63
17E-11,6.337E-11,7.104E-11,7.986E-11,9.019E-11,1.026E-10,4.05E-11,4
2.889E-11,5.318E-11,5.966E-11,6.667E-11,7.47E-11,8.34E-11,9.401E-
311,3.6E-11,4.183E-11,4.769E-11,5.430E-11,5.945E-11,6.59E-11,7.302E
4.11,8.108E-11,3.7E-11,3.781E-11,4.308E-11,4.84E-11,5.374E-11,5.931E
5.11,6.528E-11,7.103E-11,7.63E-11,8.11E-11,8.61E-11,9.145E-11,9.69E-11,
65.402E-11,5.923E-11,6.479E-11,0.0,3.001E-11,3.559E-11,4.049E-11,4.5
709E-11,4.965E-11,5.431E-11,5.919E-11,6.4269E-11,3.246E-11,3.731E-
811,4.169E-11,4.594E-11,5.021E-11,5.461E-11,5.91E-11,6.31E-11,6.71E-11,7.
920E-11,3.615E-11,3.999E-11,4.373E-11,4.746E-11,5.11,0.0,1.652E-11)
DATA(V(1),I=671,743)=2.296E-11,2.787E-11,3.185E-11,3.543E-11,3.88
12E-11,4.213E-11,4.566E-11,4.92E-11,5.271E-11,5.652E-11,6.03E-11,6.418E-
215,3.502E-11,3.803E-11,4.11E-11,4.41E-11,4.768E-11,5.1239E-11,5.599
3E-11,2.914E-11,3.205E-11,3.483E-11,3.761E-11,4.04E-11,4.344E-11,4.6
47E-11,2.412E-11,2.706E-11,2.976E-11,3.233E-11,3.51E-11,3.781E-11,4.
5531E-11,9.69E-11,2.276E-11,2.551E-11,2.802E-11,3.039E-11,3.27E-12
6.131E-11,1.506E-11,1.869E-11,2.179E-11,2.438E-11,2.67E-11,2.91E-11,
7E-11,8.57E-12,1.207E-11,1.519E-11,1.828E-11,2.114E-11,2.359E-11,2.
8576E-11,2.78E-11,9.90E-12,1.292E-11,1.556E-11,1.818E-11,2.075E-11,
92.305E-11,2.51E-11,2.699E-11,2.89E-11,3.08E-11,3.27E-11,3.467E-11)
DATA(V(1),I=744,807)=1.832E-11,2.059E-11,2.272E-11,2.465E-11,2.64
12E-11,2.828E-11,3.01E-11,3.20E-11,3.39E-11,3.58E-11,3.77E-11,3.96E-11,
2.423E-11,2.604E-11,2.78E-11,2.96E-11,3.14E-11,3.32E-11,3.50E-11,3.68E-
311,8.207E-11,8.4E-11,7.818E-11,1.117E-10,1.078E-10,1.044E-10,1.013E
4.10,1.356E-10,1.304E-10,1.259E-10,1.218E-10,1.158E-10,1.108E-10,1.058E-10,
586E-10,1.856E-10,1.863E-10,1.864E-10,2.043E-10,2.079E-10,2.092E-1
2.2164E-10,2.233E-10,2.265E-10,2.251E-10,2.346E-10,2.395E-10,2.32
7E-10,2.441E-10,2.501E-10,1.507E-10,1.508E-10,1.509E-10,1.509E-10,1
8.508E-10,1.952E-10,1.956E-10,1.959E-10,1.96E-10,1.96E-10,2.03E-1
90,2.048E-10,2.057E-10,2.063E-10,2.067E-10,2.07E-10,2.07E-10,2.07E-10,
DATA(V(1),I=808,820)=2.191E-10,2.202E-10,2.21E-10,2.236E-10,2.271
1E-10,2.291E-10,2.305E-10,2.316E-10,2.306E-10,2.347E-10,2.37E-10,2.
2367E-10,2.4E-10)
END

```

```

GO TO 33
14 IF(P.LT.2000.0) GO TO 16
IF(M.GE.0.) GO TO 15
N=14
GO TO 30
15 N=15
GO TO 33
16 IF(M.GE.-30.0) GO TO 17
N=16
GO TO 30
17 N=17
GO TO 33
18 IF(M.GE.-70.0) GO TO 19
N=18
IF(M.GT.(-132.82+0.04*P)) GO TO 22
GO TO 30
19 IF(M.GE.-20.0) GO TO 20
N=19
GO TO 22
20 N=20
22 IF(P.GE.187.506) GO TO 33
DO 23 I=2,19
23 CONTINUE
IF(P-PL(I))24,24,23
24 D=PL(I)-PL(I-1)
D8=P-PL(I)-P
HGAS=(MG(I)*DB+HG(I-1)*DF)/D
IF(M.GE.HGAS) GO TO 33
HLIQ=(HL(I)*DB+HL(I-1)*DF)/D
IF(M.LE.HLIQ) GO TO 33
VLIQ=(VL(I)*DB+VL(I-1)*DF)/D
PHVISC=((VG(I)*DB+VG(I-1)*DF)/(HGAS-HLIQ)+(H-HLIQ)/(HGAS-HLIQ))+VLIQ
RETURN
30 PR=P/500.0
I=PR
IF(I.GT.9) I=9
F=PR-I
MSOL=F*MS(I+2)*(1.0-F)*MS(I+1)
IF(M.LT.MSOL) M=MSOL
33 FP=(P-8P(N))/DP(N)
IP=FP
IF(IP.GT.MX(N)) IP=MX(N)
F=FP-IP
FP=1.0-F
FM=(H-8H(N))/DH(N)
IM=FM
FF=FM-IM
FM=1.0-FF
J=I+JP(N)
PHVISC=FP*FM*V(I)+F*FM*V(I+1)+FP*FF*V(J)+F*FF*V(J+1)
RETURN
END

```



```

3,1314.,1633.,1853.,2024.,2176.,3436.,4078.,4610.,893.,1246.,1567.,
4178.,1959.,2112.,2954.,3615.,4160.,915.,1212.,1516.,1730.,190.,2053.,2673.,3284.,3633.,998.,1202.,1480.,
5853.,2673.,3284.,3633.,998.,1202.,1480.,1683.,1855.,2000.,0.,0.,0.,1114.,1237.,1400.,1575.,1709.,1845.,10
6,1114.,1237.,1400.,1575.,1709.,1845.,1004.,907.,1148.,1190.,1299.,
71421.,1543.,1658.,1773.,1155.,1166.,1232.,1293.,1384.,1477.,1570.,
81663.,1757.,1292.,1324.,1357.,1398.,1473.,1548.,1622.,1699.,1777.,
911270.,1170.,12240.,12650.,13040.,11520.,12060.,12610.,13140.,
DATA(V(I),I-317,323)=13620.,11740.,12320.,12940.,13560.,14110.,0.
1)
P=PRES
IF(P.LT.1.0) P=1.0
H=ENTH
IF(M.LT.400.) GO TO 6
IF(M.LT.500.) GO TO 4
IF(M.GE.25000.) H=24999.99999
IF(P.GE.100.) GO TO 2
IF(P.GE.10.) GO TO 1
N=1
M=18
GO TO 33
1 N=2
M=17
GO TO 33
2 IF(P.GE.1000.) GO TO 3
N=3
M=16
GO TO 33
3 N=4
M=15
GO TO 33
4 IF(M.LT.600.) GO TO 5
N=5
GO TO 33
5 N=6
GO TO 33
6 IF(P.LT.2000.) GO TO 7
N=7
GO TO 30
7 IF(M.LT.100.) GO TO 9
IF(P.GE.500.) GO TO 8
N=8
GO TO 33
8 N=9
GO TO 33
9 IF(P.LT.400.) GO TO 11
IF(P.LT.1000.) GO TO 10
N=10
GO TO 30
10 N=11
GO TO 30
11 IF(M.GE.0.) GO TO 12
N=12
IF(M.LT.-132.7285+P*8.08224) GO TO 30
GO TO 20
12 IF(M.GE.20.) GO TO 13
N=13
GO TO 20
13 N=14

```

```

2246.,4078.,4636.,5092.,900.,1314.,1633.,1853.,2024.,2176.,3436.,40
378.,4610.,893.,1246.,1567.,1788.,1959.,2112.,2954.,3615.,4160.,915
4.,1212.,1516.,1730.,190.,2053.,2673.,3284.,3633.,998.,1202.,1480.,
5,1683.,1855.,2000.,0.,0.,0.,1114.,1237.,1400.,1575.,1709.,1845.,10
604.,900.,1148.,1190.,1299.,1421.,1543.,1658.,1773.,1155.,1166.,123
72.,1293.,1384.,1477.,1570.,1663.,1757.,1292.,1324.,1357.,1398.,147
83.,1548.,1622.,1699.,1777.,11270.,11770.,12240.,12650.,13040.,1152
90.,12060.,12610.,13140.,13620.,11740.,12320.,12940.,13560.,14110./
DATAAD/0./
P=PRES
IF(P.LT.1.0) P=1.0
H=ENTH
IF(M.LT.400.) GO TO 6
IF(M.LT.500.) GO TO 4
IF(M.GE.25000.) H=24999.99999
IF(P.GE.100.) GO TO 2
IF(P.GE.10.) GO TO 1
N=1
M=18
GO TO 33
1 N=2
M=17
GO TO 33
2 IF(P.GE.1000.) GO TO 3
N=3
M=16
GO TO 33
3 N=4
M=15
GO TO 33
4 IF(M.LT.600.) GO TO 5
N=5
GO TO 33
5 N=6
GO TO 33
6 IF(P.LT.2000.) GO TO 7
N=7
GO TO 30
7 IF(M.LT.100.) GO TO 9
IF(P.GE.500.) GO TO 8
N=8
GO TO 33
8 N=9
GO TO 33
9 IF(P.LT.400.) GO TO 11
IF(P.LT.1000.) GO TO 10
N=10
GO TO 30
10 N=11
GO TO 30
11 IF(M.GE.0.) GO TO 12
N=12
IF(M.LT.-132.7285+P*8.08224) GO TO 30
GO TO 20
12 IF(M.GE.20.) GO TO 13
N=13
GO TO 20
13 N=14

```

```

20 IF (P.GT.187.506) GO TO 33
DO 21 I=2,19
IF (P-R(I))22,22,21
21 CONTINUE
22 F=(P-R(I-1))/(R(I)-R(I-1))
CHL=HL(I-1)*(HL(I)-HL(I-1))*F
CHV=HV(I-1)*(HV(I)-HV(I-1))*F
IF (M.LT.CHL-OR-M.GT.CHV) GO TO 33
SVL=VL(I-1)*(VL(I)-VL(I-1))*F
SVG=VG(I-1)*(VG(I)-VG(I-1))*F
F=(H-CHL)/(CHV-CHL)
PHSOUN=SVL*(SVG-SVL)*F
RETURN
30 PR=P/587.84
I=PR
IF (I.GT.8) I=8
FI=I
F=PR-FI
FP=1.-F
G=FP*HS(I+1)+F*HS(I+2)
IF (M.LT.G)H=G
33 IF (M.LE.20000.)N1=N
FP=(P-BP(N))/DP(N)
IP=FP
IF (IP.GT.MX(N)) IP=MX(N)
FI=IP
F=FP-FI
FP=1.-F
FH=(H-BH(N1))/DH(N)
IH=FI
FI=IH
FF=FI-FI
FH=1.-FF
I=IH*JP(N1)+IP*LOC(N1)
J=I*JP(N1)
PHSOUN=FP*FH*V(I)+F*FH*V(I+1)+FP*FF*V(J)+F*FF*V(J+1)
RETURN
END

FUNCTION PHCP(PRES,ENTH)
PHCP=PHHEAT(PRES,ENTH,1)
RETURN
END
FUNCTION PHCV(PRES,ENTH)
PHCV=PHHEAT(PRES,ENTH,2)
RETURN
END
FUNCTION PHGAMH(PRES,ENTH)
PHGAMH=PHHEAT(PRES,ENTH,3)
RETURN
END
FUNCTION PHHEAT(PRES,ENTH,KTRANS)
COMMON/HPHEAT/ CP(749),CV(749)

```





```

N=9
GO TO 33
8 N=8
GO TO 33
9 IF(P.LT.600.) GO TO 13
IF(P.LT.2000.) GO TO 11
IF(H.LT.30.) GO TO 10
N=9
GO TO 33
10 N=10
GO TO 30
11 IF(P.LT.1000.) GO TO 12
N=11
GO TO 30
12 N=12
GO TO 30
13 IF(M.GE.(-45.)) GO TO 14
N=13
IF(H.LT.(-132.7285+P*0.08224)) GO TO 30
GO TO 20
14 IF(H.LT.120.) GO TO 15
N=14
GO TO 33
15 IF(P.LT.300.) GO TO 16
N=15
GO TO 33
16 IF(H.LT.60.) GO TO 17
N=16
GO TO 20
17 N=17
20 IF(P.GT.187.506) GO TO 33
DO 21 I=2,19
IF(P-R(I))22,22,21
21 CONTINUE
22 F=(P-R(I-1))/(R(I)-R(I-1))
CHL=HL(I-1)+(HL(I)-HL(I-1))*F
CHV=HV(I-1)+(HV(I)-HV(I-1))*F
IF(H.LT.CHL.OR.H.GT.CHV) GO TO 33
IF(KTR.EQ.2) GO TO 23
PHEAT=VERYBG
RETURN
23 CL=CVL(I-1)+(CVL(I)-CVL(I-1))*F
CG=CVV(I-1)+(CVV(I)-CVV(I-1))*F
PHEAT=CL+(CG-CL)*(H-CHL)/(CHV-CHL)
RETURN
30 F=P/587.84
I=F
IF(I.GT.8) I=8
FI=I
F=F-FI
V=(1.0-F)*HS(I+1)+F*HS(I+2)
IF(H.LT.V) H=V
33 IF(H.LE.20000.)N2=N
FP=(P-BP(N))/DP(N)
IP=FP
IF(1P.GT.MX(N)) IP=MX(N)
FI=IP
F=FP-FI
FP=1.-F
J=I+JP(N)

```

```

N=9
GO TO 33
10 IF(M.LT.-45..AND.P.LT.2250.)GO TO 24
N=10
GO TO 30
11 IF(P.LT.1000.) GO TO 12
N=11
GO TO 30
12 N=12
GO TO 30
13 IF(M.GE.-45.) GO TO 14
N=13
IF(H.LT.-132.7285+P*0.08224) GO TO 30
GO TO 20
14 IF(H.LT.120.) GO TO 15
N=14
GO TO 33
15 IF(P.LT.300.) GO TO 16
N=15
GO TO 33
16 IF(H.LT.60.) GO TO 17
N=16
GO TO 20
17 N=17
20 IF(P.GT.187.506) GO TO 33
DO 21 I=2,19
IF(P-R(I))22,22,21
21 CONTINUE
22 F=(P-R(I-1))/(R(I)-R(I-1))
CHL=HL(I-1)+(HL(I)-HL(I-1))*F
CHV=HV(I-1)+(HV(I)-HV(I-1))*F
IF(H.LT.CHL.OR.H.GT.CHV) GO TO 33
IF(KTR.EQ.2) GO TO 23
PHEAT=VERYBG
RETURN
23 CL=CVL(I-1)+(CVL(I)-CVL(I-1))*F
CG=CVV(I-1)+(CVV(I)-CVV(I-1))*F
PHEAT=CL+(CG-CL)*(H-CHL)/(CHV-CHL)
RETURN
24 N=11
30 F=P/587.84
I=F
IF(I.GT.8) I=8
FI=I
F=F-FI
V=(1.0-F)*HS(I+1)+F*HS(I+2)
IF(H.LT.V) H=V
33 IF(H.LE.20000.)N1=N
FP=(P-BP(N))/DP(N)
IP=FP
IF(1P.GT.MX(N)) IP=MX(N)
F=FP-IP
FP=1.-F
FM=(H-BP(N1))/DM(N)
IF(FM-IP)
FM=1.-FF
I=I+JP(N)+IP*LOC(N1)
J=I+JP(N)

```

```

IF (KTR.EQ.2) GO TO 35
HCP=FP*FM*CP(I)+F*FM*CP(I+1)+FP*FF*CV(J)+F*FF*CV(J+1)
IF (N.LT.13) GO TO 34
S=M*500.
HCP=HCP/(18240.46942/S-425696635.2/S/S/S-65.21553314+.07110647112*
15-2.644991367E-8*S*S/S)
HCP=HCP
PHCP=HCP
RETURN
IF (KTR.LT.3) RETURN
HCP=HCP/PHCP
RETURN
END

SUBROUTINE LOWEAT
COMMON/PHHEAT/ CP(1749), CV(1749)
DATA (CP(I), I=320,437)/2.789,2.562,3.787,3.32,3.021,4.562,3.854,3.
1453,4.5296,4.344,3.836,5.762,4.71,4.14,5.757,4.872,4.336,5.381,4.8
219,3.399,4.871,4.614,4.344,4.402,4.351,4.214,4.037,4.094,4.056,3.7
364,3.869,3.904,1.008,9365,8657,8,74,0,0,1,19,1,101,1,025,95
4,8664,8249,7596,1,296,1,201,1,12,1,05,906,9267,8671,1,365,1
524,1,142,1,064,1,002,9471,8973,1,446,1,26,1,125,1,032,9625,906
64,859,1,682,1,332,1,095,9782,8947,8335,7857,2,164,1,582,1,119
7,926,8181,749,6971,4942,7064,883,986,1,024,1,021,9377,5
8807,7459,8907,9946,1,052,1,077,1,08,6575,7922,9136,1,011,1,0
973,1,132,7164,8202,9306,1,017,1,079,1,126,1,155,7496)
DATA (CV(I), I=438,546)/8426,9284,1,004,1,066,1,109,1,142,926,8
1721,8181,783,7479,7225,6971,897,8104,749,7029,8664,6636
2,611,9189,7855,7012,6424,5987,5648,5373,5962,7935,6801
3,6072,5558,5173,4874,1,125,8437,6943,6057,5456,5013,4687
4,1227,9052,7409,6406,5728,5236,4864,1,226,9639,5085,7069
5,6351,5021,541,1,163,9961,8757,7871,7199,6668,6242,1,086,1
6,009,9285,8642,8097,763,7233,1,03,1,004,9603,9308,8931,45
776,829,9984,1,005,9986,9835,9638,9414,9183,9872,1,006,1,0
824,1,023,1,021,1,009,9977,2622,5,2,1,988,1,741,1,395,1,163,30
995,53,85,1,171,1,224,1,163,1,086,3654,5427,7354,8998,1,004)
DATA (CP(I), I=547,650)/1.034,1.03,4.282,5587,6976,8174,9077,9
1699,9984,492,6003,7064,7944,8823,9449,9872,1,293,1,268,1
2198,1,099,1,97,1,063,1,028,9859,9385,1,529,1,366,1,249,1,161,1
3091,1,034,9871,9476,9134,1,811,1,718,1,456,1,284,1,162,1,021,1
4001,9445,6979,2,837,2,742,0,171,503,1,333,1,171,0,506,3715,90
554,0,4,578,2,244,1,633,1,333,1,132,9962,0,0,37,29,516,3,177,2,0
687,3,748,2,244,1,633,1,333,1,132,9962,0,0,37,29,516,3,177,2,0
74,1,541,1,259,1,079,0,4,9,88,3,905,2,373,1,227,0,6,57,7,716,4,255,
8,0,25,93,7,327,3,608,2,39,1,792,1,453,1,227,0,6,57,7,716,4,255,
92,744,2,1,1,692,1,426,1,238,3,3,305,3,395,2,566,2,066,1,744)
DATA (CP(I), I=659,749)/1.515,1,342,1,21,1,922,1,194,1,922,1,748,1,5
188,1,434,1,34,1,247,1,163,5,363,5,087,4,955,4,873,4,814,6,779,6,2
237,5,966,5,793,5,668,8,417,6,02,7,182,6,909,6,709,7,441,6,309,5,8
3,3,5,612,5,467,5,363,8,841,7,339,6,703,6,378,6,169,6,019,10,32,8,4
465,7,655,7,237,6,964,6,774,11,85,9,634,8,682,8,178,7,846,7,598,8,3
567,7,36,6,875,9,872,8,09,11,69,10,16,9,395,13,41,1,64,10,74,1
64,2,10,6,9,54,8,964,8,61,8,333,8,115,16,97,12,1,11,4,10,16,10,3
7,9,95,9,678,13,7,2,14,86,13,39,12,56,12,04,11,63,11,31,22,45,16,99,
815,33,14,42,13,8,13,33,12,96)
END

```

```

SUBROUTINE H C SUB P
COMMON/HPEAT/ CP(749),CV(749)
DATA(CP(1),1)=108,215,4,861,4,773,4,711,4,664,8,836,6,743,6,189,5
1,91,5,731,5,602,5,503,11,45,8,569,7,756,7,331,7,052,6,848,6,689,14
2,2,10,6,9,545,8,984,8,61,8,333,8,115,3,471,1,528,3,504,3,503,3,609
3,3,618,3,797,3,783,3,909,4,213,3,317,3,697,3,878,3,983,3,547,3,65,
4,3,723,3,886,3,544,3,587,3,573,3,528,2,471,3,189,3,555,3,46,3,59
50,3,633,3,326,3,076,2,866,2,605,2,949,3,228,3,437,3,576,3,648,3,5
67,3,411,3,236,2,939,3,151,3,331,3,477,3,591,3,819,3,81,3,704,3,584
7,3,303,3,445,3,573,3,602,3,772,3,958,3,974,3,923,3,84,3,593,3,7,3
8,2,96,3,952,4,124,4,189,4,154,4,112,3,773,3,856,3,931,3,997,4,4
9055,4,214,2,27,4,279,4,263,3,861,3,546,4,006,4,059,4,107,4,249,1
DATA(CP(1),1)=216,327,4,312,4,337,4,339,3,925,3,977,4,025,4,074,4
111,4,232,4,303,4,344,3,563,3,909,3,939,3,97,4,0,4,031,4,152,4,234,4
1275,4,317,1,1,591,1,088,4,462,0,2,281,1,638,1,079,0,2,61,2,07,1,1516
3,84,2,87,2,38,1,916,1,35,3,08,2,613,2,223,1,787,3,259,2,79,2,455,
4,2,106,3,467,3,026,2,716,2,448,3,578,3,196,2,921,2,683,3,633,3,326,
53,076,2,866,8,868,4,5399,2,194,0,0,1,934,1,697,1,47,2,281,0,761,2
675,2,511,2,308,2,127,1,954,3,553,3,126,2,692,2,709,2,551,4,033,3,6
712,3,331,3,123,2,988,4,361,3,937,3,648,3,429,3,259,4,363,4,055,3,8
901,3,623,3,467,4,152,3,997,3,843,3,704,3,578,3,904,3,836,3,768,3,7
901,3,633,1,089,4,891,7,1,836,1,611,1,417,2,471,2,244,2,048,3,094)
END

SUBROUTINE H C SUB V
COMMON/HPEAT/ CP(749),CV(749)
DATA(CV(1),1)=329,430=1,499,1,544,1,546,1,547,1,564,1,564,1,569,1
1,561,1,572,1,576,1,598,1,582,1,608,1,596,1,596,1,597,1,612,1,608,1
2,6,21,6,1,617,1,626,1,612,1,627,1,639,1,62,1,638,1,655,1,632,1,6
357,1,679,1,1,1,057,1,017,9735,9310,0,1,291,1,252,1,211,1,17,1
4,131,1,091,1,044,1,406,1,385,1,362,1,335,1,305,1,272,1,233,1,146,1,4
552,1,441,1,028,1,413,1,395,1,373,1,349,1,307,1,482,1,476,1,47,1,46
621,452,1,537,1,521,1,51,1,506,1,503,1,5,1,496,1,589,1,561,1,536,1
7,520,1,524,1,523,1,522,1,478,1,59,1,598,1,601,1,608,1,61,1,611,1,4
878,1,542,1,566,1,578,1,594,1,604,1,611,1,479,1,525,1,552,1,571,1,5
99,1,604,1,615,1,481,1,519,1,547,1,57,1,593,1,61,1,621,1,486,1,517)
DATA(CV(1),1)=439,946=1,548,1,574,1,595,1,618,1,632,1,528,1,529,1
1,524,1,523,1,522,1,522,1,522,1,522,1,546,1,542,1,54,1,539,1,539,1
2539,1,582,1,571,562,1,557,1,554,1,553,1,552,1,625,1,601,1,586,1,5
376,1,571,566,1,564,1,569,1,64,1,614,1,598,1,587,1,579,1,574,1,732,
41,675,1,642,1,619,1,603,1,592,1,584,1,759,1,697,1,662,1,636,1,617,
51,608,1,595,1,743,1,7,1,668,1,644,1,626,1,613,1,684,1,708,1,681,1
6698,1,64,1,628,1,617,1,608,1,668,1,654,1,642,1,632,1,623,1,615,1,6
711,1,631,628,1,624,1,62,1,617,1,614,1,611,1,611,1,601,1,605,1,608,1,609
98,1,61,1,611,1,611,1,478,1,7,1,97,2,035,1,937,1,612,1,743,1,478,1,68
DATA(CV(1),1)=507,658=1,684,1,668,1,478,1,559,1,623,1,649,1,641,1
1,633,1,63,1,478,1,529,1,58,1,589,1,598,1,59,1,601,1,535,1,531,1,5
229,1,527,1,525,1,523,1,522,1,521,1,52,1,567,1,56,1,554,1,549,1,545
3,1,542,1,539,1,537,1,535,1,531,1,596,1,585,1,576,1,563,1,563,1,559
4,1,555,1,552,1,566,1,649,1,631,1,614,1,601,1,591,1,583,1,576,1,571
5,0,1,795,1,731,667,1,645,1,628,1,615,1,604,1,595,0,2,172,2,024,
61,076,1,768,1,701,1,655,1,638,1,625,0,0,2,336,2,12,1,942,1,817,1
7,732,1,692,1,666,0,0,2,442,2,244,2,065,1,698,1,791,1,745,1,709,0
8,0,2,356,2,234,2,893,1,943,1,83,1,773,1,732,0,1,500,2,222,2,144
9,2,043,1,92,1,856,1,793,1,743,2,152,2,372,2,093,2,037,1,959,1,897,1
DATA(CV(1),1)=659,749=1,628,1,773,1,757,1,855,1,977,2,006,1,937,1
1,671,1,833,1,792,1,764,1,743,4,263,4,018,3,9,2,826,3,773,5,498,5,0

```

```

224.4,788,6.636,4.527,6.094,6.194,5.836,5.595,5.824,6.115,5.105,4.6
39.4,485,4.356,4.283,7.332,6.804,5.444,5.157,4.973,4.84,6.6,97.6
4262.5,966.5,657.5,498.9,874.7,959.7,135.6,698.6,412.6,196.6,99.6,6
5042.5,618.0,351.7,223.6,668.9,794.8,454.7,785.1,122.9,695.8,916.12,
614.9,929.7,99.7,49.7,156.6,909.6,745.4,452.1,7.9,631.9,0.84,6.15
7.8,31.8,089,16.86,12.57,11.28,10.58,10.10,1.9,742.9,459.12,14.37,1
92.91,12.11,11.58,11.17,10.84)
END

SUBROUTINE DDCVCP
COMMON/MPHEAT/CP(1749),CV(1749)
DATA(CP(1),151,107)=3.792,3.709,3.787,3.785,3.783,6.057,4.047,4.0
141,4.037,3.036,4.463,4.382,4.345,4.321,4.305,5.363,5.087,4.955,4.8
273,4.814,3.797,3.794,3.793,3.792,3.792,3.943,2.933,3.93,3.92
38,3.927,3.926,4.45,4.093,4.076,4.066,4.061,4.057,4.522,4.34,4.27
48,4.249,4.231,4.26,5.197,4.774,4.614,4.54,4.495,4.463,6.195,5.435,
55,4.354,4.991,4.902,4.856,7.441,6.309,5.843,5.612,5.467,5.363,3.797,
63,797,3.797,3.954,3.943,3.938,4.204,4.144,4.118,4.713,4.516,4.431,
75,611,5.178,4.986,6.869,6.15,5.814,8.307,7.36,6.875,3.797,3.797,3.
8797,3.797,3.797,3.797,4.09,3.99,3.971,3.962,3.957,3.953,3.95
91,4.886,4.399,4.298,4.251,4.223,4.203,4.189,6.539,5.296,5.002)
DATA(CV(1),151,107)=2.809,2.805,2.803,2.8,2.797,3.07,3.061,3.055,
13,051,3.048,3.453,3.38,3.345,3.324,3.308,4.263,4.018,3.9,3.826,3.7
273,2.812,2.811,2.811,2.812,2.812,2.809,2.956,2.946,2.944,2.943,2.942
3,2.94,3.152,3.103,3.086,3.078,3.074,3.07,3.503,3.339,3.28,3.253,3.
4237,3.262,4.118,3.735,3.593,3.523,3.482,3.453,5.013,4.331,4.061,3.9
532,3.852,3.801,6.115,5.105,4.69,4.485,4.356,4.263,2.812,2.812,2.812,2.81
62,2.967,2.956,2.952,3.206,3.15,3.127,3.679,3.498,3.42,4.495,4.102,
73,326,5.621,4.973,4.671,6.939,6.042,5.612,8.812,2.812,2.812,2.812,2
8.812,2.812,2.812,3.095,3.001,2.983,2.974,2.972,2.966,2.964,3.847,3.
937,3.293,3.25,3.224,3.205,3.192,5.353,4.213,3.94,3.814,3.733)
DATA(CV(1),110,217)=3.676,3.636,7.425,5.523,5.021,4.767,4.604,4
1.487,4.397,9.75,7.151,6.419,6.037,5.785,5.602,5.459,12.148,9.929,7
299,7.49,7.156,6.909,6.715,2.486,2.522,5.19,2.515,2.643,2.633,2.812
3,2.797,2.924,3.039,3.121,2.712,2.802,2.875,2.562,2.62,2.688,2.503,
42,536,2.583,2.488,2.503,2.521,1.486,1.563,1.617,1.652,1.679,1.751,1
5.777,1.784,1.784,1.621,1.702,1.768,1.822,1.866,1.963,1.931,1.991,1
6.972,1.954,2.017,2.07,2.112,2.152,2.254,2.279,2.277,2.257,2.317,2.
7351,2.384,2.412,2.437,2.505,2.53,2.524,2.496,2.607,2.635,2.659,2.6
882,2.702,2.761,2.792,2.801,2.794,2.788,2.812,8.3,2.848,2.865,2.918
9,2.952,2.97,2.77,2.896,7.314,2.93,2.946,2.96,3.009,3.045,3.069)
DATA(CV(1),1218,328)=3.084,2.94,2.955,2.969,2.983,2.995,3.041,3.
1079,3.109,3.132,2.924,2.935,2.947,2.959,2.97,3.016,3.055,3.088,3.1
221,1.367,1.051,785,0.1,507,1.291,1.069,0.1,1.579,1.485,1.555,1.906,
31,086,1.579,1.453,1.202,1.617,1.627,1.572,1.41,1.635,1.644,1.633,1
4.597,1.667,1.699,1.689,1.668,1.7,1.728,1.739,1.732,1.751,1.777,1.78
54,1.784,9207,7.489,5771,0.0,1.351,1.271,1.186,1.115,1.021,523
6,1.51,1.466,1.452,1.404,1.569,1.575,1.576,1.574,1.565,1.579,1.588,
71,597,1.684,6.611,6.160,6.167,1.627,1.635,1.635,1.627,1.635,1.647,1.6
859,1.667,1.645,1.662,1.677,1.691,1.7,1.679,1.697,1.715,1.733,1.751,
9.995,8.876,7.797,1.289,1.213,1.155,1.452,1.424,1.387,1.515,1.51)
END

```

```

4.732,1.751,1.777,1.784,1.784,9207,7.489,5771,0.0,1.351,1.271,1
1.186,1.115,1.102,1.523,1.511,1.486,1.452,1.404,1.569,1.575,1.576,1.5
674,1.565,1.579,1.588,1.597,1.604,1.61,1.6,1.608,1.617,1.627,1.635,
71,623,1.635,1.647,1.659,1.667,1.665,1.662,1.677,1.69,1.7,1.679,1.6
897,1.15,1.733,1.751,995,876,797,1.289,1.213,1.155,1.452,1.424,
91,387,1.515,1.511,1.499,1.544,1.541,1.547,1.564,1.564,1.569,1.581,
DATA(AK(1),572,1.576,1.598,1.582,1.583,1.608,1.596,1.597,1.612,1.608
1,1.612,1.61,1.617,1.626,1.621,627,1.639,1.62,1.638,1.655,1.632,1
2,657,1.679,1.1,1.057,1.017,975,931,0.0,1.291,1.25,1.211,1.17
3,1.13,1.09,1.044,1.406,1.385,1.362,1.335,1.305,1.272,1.234,1.46,1
4,422,1.441,1.428,1.413,1.395,1.373,1.496,1.487,1.482,1.476,1.471,
5,62,1.452,1.537,1.521,1.511,1.506,1.503,1.5,1.496,1.589,1.561,1.538
6,1.528,1.524,1.523,1.522,1.478,1.58,1.598,1.601,1.608,1.61,1.611,
7,478,1.542,1.566,1.578,1.584,1.604,1.611,1.479,1.525,1.552,1.571,1
8,59,1.604,1.615,1.481,1.519,1.547,1.57,1.593,1.61,1.621,1.486,1.51
97,1.548,1.574,1.595,1.618,1.632,1.528,1.526,1.524,1.523,1.523/
DATA(AK(1),522,1.522,1.522,1.546,1.542,1.54,1.539,1.539,1.539,1.582,
11,57,1.562,1.557,1.554,1.553,1.552,1.625,1.601,1.586,1.576,1.571,
2566,1.564,1.69,1.64,1.614,1.598,1.587,1.579,1.574,1.732,1.675,1.64
32,1.619,1.603,1.592,1.584,1.759,1.697,1.662,1.636,1.617,1.604,1.59
45,1.743,1.7,1.668,1.644,1.626,1.613,1.604,1.708,1.681,1.658,1.641
5.628,1.617,1.608,1.668,1.654,1.642,1.632,1.631,1.611,1.608,1.61,1.61
6628,1.624,1.62,1.617,1.614,1.611,1.601,1.605,1.608,1.609,1.61,1.61
7,1.611,1.478,1.7,1.97,2.03,1.937,1.812,1.743,1.478,1.588,1.781,1.
8837,1.802,1.748,1.708,1.478,1.616,1.685,1.741,1.709,1.684,1.668,1.
9478,1.559,1.623,1.649,1.64,1.633,1.63,1.478,1.529,1.529,1.523,1.522
DATA(AK(1),598,1.598,1.601,1.535,1.531,1.529,1.527,1.525,1.523,1.522
1,523,1.521,1.587,1.561,1.554,1.549,1.545,1.542,1.539,1.537,1.535,1
2,603,1.596,1.585,1.576,1.569,1.563,1.559,1.555,1.552,1.666,1.649,1
3,631,1.614,1.601,1.591,1.583,1.576,1.571,0.1,795,1.73,1.667,1.645
4,1.628,1.615,1.604,1.595,0.2,172,2.024,1.876,1.766,1.701,1.655,1.
5638,1.62,0.0,0.2,336,2.1,1.942,1.817,1.732,1.692,1.666,0.0,0.2,4
642,2.244,2.065,1.898,1.791,1.745,1.709,0.0,2.356,2.234,2.033,1.9
743,1.83,1.773,1.732,0.2,506,2.227,2.144,2.043,1.927,1.856,1.793,1.9
8,743,2.15,2.372,2.093,2.037,1.959,1.887,1.828,1.773,1.757,1.855,1.
997,2.006,1.937,1.871,1.833,1.792,1.764,1.743,2.63,4.018,3.9/
DATA(AK(1),3.826,3.773,5.498,0.024,4.788,4.836,4.527,6.894,6.194,5.836
1,5.595,5.426,6.115,5.105,4.694,4.485,4.356,4.263,7.332,6.304,5.444,
25,157,4.973,4.84,8.6,6.97,6.262,5.896,5.657,5.498,9.874,7.959,7.13
35,6.698,6.412,6.196,6.939,6.042,5.61,8.351,7.223,6.608,9.794,8.454
4,7.785,11.22,9.695,8.916,12.14,8.929,7.99,7.49,7.156,6.909,6.715,1
54,52,10.76,9.631,9.024,8.615,8.31,8.069,16.86,12.57,11.28,10.58,10
6,1.9,742.9,459.12,14.37,12.91,12.11,11.58,11.17,10.84/
END

```

# FUNCTION PHLFAC(PRES,ENTH)

```

COMMON/DATLLOC(C(735))
DIMENSION LOC(19),JP(19),DP(19),DM(19),BP(19),BM(19),MX(19),
1PL(19),ML(19),MG(19),CL(19),CG(19),HS(11),C(735)
DATA LOC=1,29,50,86,149,173,191,269,339,375,407,461,493,517,529,
1553,577,601,661
DATA JP=4,3,4,7,4,3,6,7,6,4,6,4,4,2,3,3,3,4,5
DATA DM=2,1,2,5,2,1,4,5,4,2,4,2,0,1,1,1,2,3
DATA BP=0,0,0,490,132,305,500,1000,2000,0,0,20,500,2000,
10,0,0,0,100,0,0,11
DATA DP=160,250,170,20,65,250,200,500,100,160,300,1000,
1500,3000,1500,300,40,10,11
DATA BM=-135,-105,-115,-45,-45,-75,-95,-60,70,145,125,
175,425,1800,11000,11000,11000,11000,11000,11000,
12000,2000,2000,1000,1000,
DATA PL=1,022,2,4,8,14,25,43,69,99,128,151,165,176,182
1,185,186,5,187,25,187,468,75,187,51
DATA ML=-132,8,-129,13,-124,25,-117,79,-110,86,-101,3,-89,0,
1-74,22,-58,58,-43,43,-30,07,-20,56,-11,13,-4,27,1,17,5,54,10,83,
214,29,16,36
DATA MG=60,31,65,11,70,59,76,35,80,98,85,11,87,40,86,54,81,94,
174,15,64,83,56,86,47,34,39,56,33,46,28,34,22,31,18,66,16,55,
114,08,31,36,48,53
DATA CG=2,639E+003,2,638E+003,2,638E+003,2,638E+003,2,638E+003,
13,038E+003,3,358E+003,3,861E+003,4,649E+003,5,987E+003,6,927E+003,
21,152E+003,1,352E+004,2,265E+004,4,104E+004,8,249E+004,2,283E+005,
33,929E+009,8,667E+008
DATA CL=1,507E+003,1,802E+003,2,114E+003,2,447E+003,2,751E+003,
13,148E+003,3,589E+003,4,073E+003,4,659E+003,5,491E+003,6,927E+003,
29,125E+003,1,352E+004,2,265E+004,4,104E+004,8,249E+004,2,283E+005,
39,773E+005,1,041E+009
DATA AA=1300,860,8,0,0,1775,1268,1000,0,2077,1680,1205,92,
15,2355,2021,1613,1200,2587,12291,1957,1566,2817,2523,223
23,1899,3036,2750,2465,2179,3036,2588,2140,3423,3013,260
36,3777,3371,3004,4139,3687,3335,4567,3987,3617,5137,428
47,3868,6122,4602,4091,1526,1100,0,1876,1450,1100,0,
52160,1796,1362,1100,2395,2089,1717,1663,2623,2330,2021,
61843,2832,2558,2267,1934,3019,2769,2497,2207,3190,2956,
7210,4214,7228,6,229,192,4,192,8,198,1,207,5,223,3,177,2,221,4,
9371,6,301,268,6,250,6,241,3,0,1799,1458,557,5,389,4,311,4,
DATA AB=263,6,0,53610,3967,1197,582,6,384,5,286,3,0,1,981E5,21
1500,1844,746,430,9,293,3,1303,10580,1557,1896,3,553,2,388,8,2
295,553,453,8,1567,9,457,5,379,322,3,282,5,260,273,6,279,8,277
3,1,272,2,266,3,262,5,5,4421,4,401,4,187,4,091,5,184,4,875,4,688,4,54
48,6435,16364,6009,5739,5534,3335,3015,2661,2868,3586,331
66,4295,3988,3755,4657,4296,4072,5060,4540,4323,5409,476
78,4529,1656,1197,1100,0,0,0,2216,1833,1413,1300,10,0,
82654,2344,41995,1580,1400,0,3015,2753,2459,3356,3351,1745,136
92,3308,3085,2844,2576,2267,1921,3553,3356,3351,1745,136
DATA AC=2682,2403,3755,3585,3403,3213,3007,2781,3923,3763,
1,3607,3448,3272,3081,4072,3917,3772,3630,3484,3327,4205,
2,4053,3917,3785,3653,3518,4323,4473,4402,3920,3379,3677,

```

# FUNCTION PHLFAC(PRES,ENTH)

```

COMMON/DATLLOC(C(735))
DIMENSION LOC(19),JP(19),DP(19),DM(19),BP(19),BM(19),MX(19),
1PL(19),ML(19),MG(19),CL(19),CG(19),HS(11),C(735)
DATA LOC=1,29,50,86,149,173,191,269,339,375,407,461,493,517,529,
1553,577,601,661
DATA JP=4,3,4,7,4,3,6,7,6,4,6,4,4,2,3,3,3,4,5
DATA DM=2,1,2,5,2,1,4,5,4,2,4,2,0,1,1,1,2,3
DATA BP=0,0,0,490,132,305,500,1000,2000,0,0,20,500,2000,
10,0,0,0,100,0,0,11
DATA DP=160,250,170,20,65,250,200,500,100,160,300,1000,
1500,3000,1500,300,40,10,11
DATA BM=-135,-105,-115,-45,-45,-75,-95,-60,70,145,125,
175,425,1800,11000,11000,11000,11000,11000,11000,
12000,2000,2000,1000,1000,
DATA PL=1,022,2,4,8,14,25,43,69,99,128,151,165,176,182
1,185,186,5,187,25,187,468,75,187,51
DATA ML=-132,8,-129,13,-124,25,-117,79,-110,86,-101,3,-89,0,
1-74,22,-58,58,-43,43,-30,07,-20,56,-11,13,-4,27,1,17,5,54,10,83,
214,29,16,36
DATA MG=60,31,65,11,70,59,76,35,80,98,85,11,87,40,86,54,81,94,
174,15,64,83,56,86,47,34,39,56,33,46,28,34,22,31,18,66,16,55,
114,08,31,36,48,53
DATA CG=2,639E+003,2,638E+003,2,638E+003,2,638E+003,2,638E+003,
13,038E+003,3,358E+003,3,861E+003,4,649E+003,5,987E+003,6,927E+003,
21,152E+003,1,352E+004,2,265E+004,4,104E+004,8,249E+004,2,283E+005,
33,929E+009,8,667E+008
DATA CL=1,507E+003,1,802E+003,2,114E+003,2,447E+003,2,751E+003,
13,148E+003,3,589E+003,4,073E+003,4,659E+003,5,491E+003,6,927E+003,
29,125E+003,1,352E+004,2,265E+004,4,104E+004,8,249E+004,2,283E+005,
39,773E+005,1,041E+009
DATA AA=1300,860,8,0,0,1775,1268,1000,0,2077,1680,1205,92,
15,2355,2021,1613,1200,2587,12291,1957,1566,2817,2523,223
23,1899,3036,2750,2465,2179,3036,2588,2140,3423,3013,260
36,3777,3371,3004,4139,3687,3335,4567,3987,3617,5137,428
47,3868,6122,4602,4091,1526,1100,0,1876,1450,1100,0,
52160,1796,1362,1100,2395,2089,1717,1663,2623,2330,2021,
61843,2832,2558,2267,1934,3019,2769,2497,2207,3190,2956,
7210,4214,7228,6,229,192,4,192,8,198,1,207,5,223,3,177,2,221,4,
9371,6,301,268,6,250,6,241,3,0,1799,1458,557,5,389,4,311,4,
DATA AB=263,6,0,53610,3967,1197,582,6,384,5,286,3,0,1,981E5,21
1500,1844,746,430,9,293,3,1303,10580,1557,1896,3,553,2,388,8,2
295,553,453,8,1567,9,457,5,379,322,3,282,5,260,273,6,279,8,277
3,1,272,2,266,3,262,5,5,4421,4,401,4,187,4,091,5,184,4,875,4,688,4,54
48,6435,16364,6009,5739,5534,3335,3015,2661,2868,3586,331
66,4295,3988,3755,4657,4296,4072,5060,4540,4323,5409,476
78,4529,1656,1197,1100,0,0,0,2216,1833,1413,1300,10,0,
82654,2344,41995,1580,1400,0,3015,2753,2459,3356,3351,1745,136
92,3308,3085,2844,2576,2267,1921,3553,3356,3351,1745,136
DATA AC=2682,2403,3755,3585,3403,3213,3007,2781,3923,3763,
1,3607,3448,3272,3081,4072,3917,3772,3630,3484,3327,4205,
2,4053,3917,3785,3653,3518,4323,4473,4402,3920,3379,3677,

```

112

```

      N=19
      GO TO 33
13 N=18
      GO TO 33
14 N=17
      GO TO 33
15 IF(P.GT.500.) GO TO 16
      N=16
      GO TO 33
16 N=15
      GO TO 33
17 DO 18 I=2,18
      IF(P-PL(I))19,19,18
18 CONTINUE
19 D=PL(I)-PL(I-1)
      DF=PL(I)-P
      DB=P-PL(I-1)
      HGAS=(HG(I)*DB+HG(I-1)*DF)/D
      IF(M.GE.HGAS) GO TO 33
      MLIQ=(ML(I)*DB+ML(I-1)*DF)/D
      IF(M.LE.MLIQ) GO TO 33
      CLIQ=(CL(I)*DB+CL(I-1)*DF)/D
      PMLFAC=((CG(I)*DB+CG(I-1)*DF)/D-CLIQ)*(M-HLIQ)/(HGAS-HLIQ)*CLIQ
      RETURN
21 N=1
      IF(M.LE.(-132.82+0.04*P)) GO TO 22
      IF(P.LT.23.) GO TO 17
      GO TO 33
22 PR=7/500.8
      I=PR
      IF(I.GT.9) I=9
      F=PR-I
      MSOL=F*HS(I+2)+(1.-F)*HS(I+1)
      IF(M.LI.MSOL) M=MSOL
      GO TO 33
26 IF(M.LT.1000.) GO TO 27
      N=14
      GO TO 33
27 N=13
      FP=(P-8P(N))/DP(N)
      IP=FP
      IF(IP.GT.MX(N)) IP=MX(N)
      F=FP-IP
      FP=1.-F
      FM=(M-8M(N))/DM(N)
      IM=FM
      FF=FM-IM
      FM=1.-FF
      I=IM*JP(N)+IP*LOC(N)
      J=I*JP(N)
      PMLFAC=(FP*FM*(I)+F*FM*(I+1)+FP*FF*(J)+F*FF*(J+1))/R
      RETURN
      END
      SUBROUTINE LFACDATA
      COMMON/DATL FAC/C(73)
      DATA (C(I), I=325,430)=4235.,4038.,3836.,3614.,3369.,3059.,2617.,*3
      132.,4451.,3972.,3782.,3569.,3333.,3020.,2566.,6730.,7006.,6396.,58

```



```

274..5534..2537..4474..5600..5698..5519..5350..2635..3930..4810..51
342..5173..5147..2718..3608..4321..4712..4875..4934..2795..3478..40
447..4423..4634..4744..2852..3400..3875..4226..4445..4588..4959..30
508..4434..4588..3066..3585..4083..4294..3190..3576..3900..4158..33
634..3611..3910..4131..3516..3761..3981..4149..3706..3901..4088..2
760..3937..4115..4279..4427..4180..4331..4471..4599..5518..4630..44
839..4217..4084..3931..5564..5008..4740..4568..4444..4332..4804..48
959..4796..4711..4627..4548..4350..4603..4707..4731..4715..4679..
DATA(C(1),I=431,532)=4158..4484..4631..4720..4759..4760..4136..44
127..44577..4698..4774..4816..4419..4460..4654..4793..4890..4952..43
284..4621..4798..4932..5032..5103..4599..4802..4958..5082..5185..52
353..4332..3972..3596..3035..4548..4298..4055..3755..4679..4507..42
499..4011..4766..4678..4522..4332..4816..4817..4711..4556..4952..50
500..4915..4758..5103..5186..5138..5014..5253..5371..5338..5248..42
622..4644..4983..5040..4561..5710..5820..5870..5904..5996..6042..1
76083..5868..45928..15900..16010..5800..25840..15875..75905..5782..1
85866..55828..55846..5782..15898..96230..96138..6695..46635..7185.
967528..7885..7966..8487..6438..78130..8297..68459..88699..
DATA(C(1),I=533,624)=8792..78951..39502..9422..49525..710891..103
172..10326..13823..11796..11431..15844..13735..13010..19162..18116.
216985..22751..10812..17268..8165..8159..96186..39009..8754..51818
3880773..9711..49412..14159..11416..10714..19005..14050..12675..2
44477..17495..15489..30287..21217..18443..36132..25265..21827..8211
58176..8121..927..6892..16768..11581..10545..10085..15758..13490
612450..20859..17667..15872..26929..22613..20032..33110..27810..2
74721..39285..33105..29472..8342..8237..8200..48184..8988..8692..7
8686..88540..10073..9405..59159..79048..611751..10501..10800..980
94214052..12056..11209..10886..16890..14032..12840..12332..
DATA(C(1),I=625,715)=20130..16429..14840..14128..23635..19175..17
1144..18225..27306..22092..19677..18558..31062..25146..22373..21065
233859..28292..25174..23692..38652..31476..28110..26390..42419..3
34677..31013..29135..46159..37863..33925..31892..49838..41830..3682
43..34650..8508..18393..28341..68310..78289..59406..81901..818984..3
58899..28840..5110909..10304..10055..9869..19739..13234..12134..116
697..11363..1126..16202..14618..13935..13423..13054..19676..17660.
716687..15969..15479..23550..21037..19426..18949..18300..27655..24
8721..23228..22183..21405..31813..28502..26798..25595..24696..36027
932437..30461..29110..28105..40245..36335..34169..32687..31571..1
DATA(C(1),I=716,735)=44441..40228..37884..36278..35064..48597..44
1853..41584..39856..38548..52692..47918..45244..43404..42011..56719
251683..48858..46913..45434..
END

```

```

FUNCTION E1ENTH(PRES,TEMP)
DIMENSION LOC(29),JP(24),HK(24),OP(24),BT(29),DT(24),PS(20)
1,YS(20),TL(10),MS(10)
COMMON/VENTHAL/1183)
DATA(LOC)=1,16,31,46,90,145,157,177,231,261,279,306,378,441,468
1,558,612,642,682,847,892,1028,1073,1103,1112,1121,1130,1160)
DATA(JP)=3,3,4,5,2,15,3,6,5,3,3,6,9,9,9,5,5,11,9,17,1,5,15)
DATA(HK)=1,1,1,2,3,0,3,4,3,4,1,1,7,7,7,3,3,9,7,15,3,3)
DATA(BP)=0,0,0,999999,0,300,0,2645,28,1,175,68,587,84,0,2645,2
18,1175,68,0,587,84,587,84,293,92,0,40,88,293,92,176,352,176,352,0
2,117,568)
DATA(OP)=1500,300,40,10,1,5070,0,1100,1175,68,92,146,96,
1293,92,1175,68,293,92,146,96,73,46,73,46,36,78,48,36,74,14,696,
214,696,7,348,44,088,14,696)
DATA(BT)=3000,3000,3000,3000,3000,3000,500,170,90,90,90,90,,
132,4,30,6,127,75,61,59,4,72,72,59,4,64,6,59,4,28,6,54,5000,
2,5000,5000,5000,5000,0)
DATA(DT)=500,500,500,200,200,500,110,18,18,18,18,7,2,5,4
1,5,4,7,2,1,8,3,3,3,6,1,8,9,8,8,5,4,1,8)
DATA(PS)=1,025,2,4,8,11,25,4,3,69,9,1,128,151,165,176,102
1,185,186,5,187,25,187,46,687,5,187,50,187,6389)
DATA(TS)=28,845,27,07,29,81,33,07,36,18,39,96,44,2,48,33,51,97,54,
179,56,72,87,08,58,57,58,99,59,18,59,29,59,34,59,353,59,356,59,4
DATA(TL)=2,8,8,6,27,175,29,310,31,299,33,176,34,962,36,672,38,317,
139,904,41,458)
DATA(MS)=157,62,136,56,-115,76,-95,46,75,59,-56,08,-36,93,-17,99
1,0,69,19,30)
DATA(HM(I),I=1,15)=10720,10750,10780,12690,12720,12750,12780,12790,12800,12810,12820,12830,12840,12850,12860,12870,12880,12890,12900,12910,12920,12930,12940,12950,12960,12970,12980,12990,13000,13010,13020,13030,13040,13050,13060,13070,13080,13090,13100,13110,13120,13130,13140,13150,13160,13170,13180,13190,13200,13210,13220,13230,13240,13250,13260,13270,13280,13290,13300,13310,13320,13330,13340,13350,13360,13370,13380,13390,13400,13410,13420,13430,13440,13450,13460,13470,13480,13490,13500,13510,13520,13530,13540,13550,13560,13570,13580,13590,13600,13610,13620,13630,13640,13650,13660,13670,13680,13690,13700,13710,13720,13730,13740,13750,13760,13770,13780,13790,13800,13810,13820,13830,13840,13850,13860,13870,13880,13890,13900,13910,13920,13930,13940,13950,13960,13970,13980,13990,14000,14010,14020,14030,14040,14050,14060,14070,14080,14090,14100,14110,14120,14130,14140,14150,14160,14170,14180,14190,14200,14210,14220,14230,14240,14250,14260,14270,14280,14290,14300,14310,14320,14330,14340,14350,14360,14370,14380,14390,14400,14410,14420,14430,14440,14450,14460,14470,14480,14490,14500,14510,14520,14530,14540,14550,14560,14570,14580,14590,14600,14610,14620,14630,14640,14650,14660,14670,14680,14690,14700,14710,14720,14730,14740,14750,14760,14770,14780,14790,14800,14810,14820,14830,14840,14850,14860,14870,14880,14890,14900,14910,14920,14930,14940,14950,14960,14970,14980,14990,15000,15010,15020,15030,15040,15050,15060,15070,15080,15090,15100,15110,15120,15130,15140,15150,15160,15170,15180,15190,15200,15210,15220,15230,15240,15250,15260,15270,15280,15290,15300,15310,15320,15330,15340,15350,15360,15370,15380,15390,15400,15410,15420,15430,15440,15450,15460,15470,15480,15490,15500,15510,15520,15530,15540,15550,15560,15570,15580,15590,15600,15610,15620,15630,15640,15650,15660,15670,15680,15690,15700,15710,15720,15730,15740,15750,15760,15770,15780,15790,15800,15810,15820,15830,15840,15850,15860,15870,15880,15890,15900,15910,15920,15930,15940,15950,15960,15970,15980,15990,16000,16010,16020,16030,16040,16050,16060,16070,16080,16090,16100,16110,16120,16130,16140,16150,16160,16170,16180,16190,16200,16210,16220,16230,16240,16250,16260,16270,16280,16290,16300,16310,16320,16330,16340,16350,16360,16370,16380,16390,16400,16410,16420,16430,16440,16450,16460,16470,16480,16490,16500,16510,16520,16530,16540,16550,16560,16570,16580,16590,16600,16610,16620,16630,16640,16650,16660,16670,16680,16690,16700,16710,16720,16730,16740,16750,16760,16770,16780,16790,16800,16810,16820,16830,16840,16850,16860,16870,16880,16890,16900,16910,16920,16930,16940,16950,16960,16970,16980,16990,17000,17010,17020,17030,17040,17050,17060,17070,17080,17090,17100,17110,17120,17130,17140,17150,17160,17170,17180,17190,17200,17210,17220,17230,17240,17250,17260,17270,17280,17290,17300,17310,17320,17330,17340,17350,17360,17370,17380,17390,17400,17410,17420,17430,17440,17450,17460,17470,17480,17490,17500,17510,17520,1
```

```

250..53610..39900..34070..32610..53710..46340..39810..36850..)
DATA1(MII),I=1330,1159)=32960..28900..27090..26000..25260..,40130..,
134330..31710..30130..29050..49950..41170..37530..35320..33810..596
210..449530..44710..41750..39630..71190..59240..53210..49420..46750.
382020..69950..62910..58310..55020..)
P=PRES
IF(P.LT.1.0) P=1.0
Y=TEMP
IF(T.LT.90.0) GO TO 10
IF(T.LT.300.0) GO TO 5
IF(T.GE.6000.0) T=5999.9999
IF(P.LT.30.0) GO TO 3
IF(P.LT.80.0) GO TO 2
IF(P.LT.500.0) GO TO 1
N=1
N1=25
GO TO 33
1 N=2
N1=26
GO TO 33
2 N=3
N1=27
GO TO 33
3 IF(P.LT.5.0) GO TO 4
N=4
N1=29
GO TO 33
4 N=5
N1=28
GO TO 33
5 IF(T.LT.180.0) GO TO 70
IF(T.LT.500.0) GO TO 6
N=6
GO TO 33
6 N=7
GO TO 33
70 IF(P.LT.1175.68) GO TO 8
IF(P.LT.2645.28) GO TO 7
N=8
GO TO 33
7 N=9
GO TO 33
8 IF(P.LT.597.84) GO TO 9
N=10
GO TO 33
9 N=11
GO TO 33
10 IF(P.LT.1175.68) GO TO 12
IF(P.LT.2645.28) GO TO 11
N=12
GO TO 30
11 N=13
GO TO 30
12 IF(T.GE.59.4) GO TO 15
N=14
IF(P.GE.1A7.6385) GO TO 30
DO 13 I=2,20
IF(P-PS(I)) 14,14,13

```

```

7.494,3.476,7.578,5.562,7.540,9.635,3.626,0.618,3.-36.36,-.4208,35.
879,-23.08,12.56,7.71,-6.59,28.33,62.96,14.03,48.09,82.13,39.11,72
9.05,1105.4,68.26,99.93,132.5,100.7,130.9,162.7,135.4,164.1,194.9/
DATAAD/171.5,198.4,228.3,-85.42,-76.04,-66.75,-57.54,-48.41,-39.52
1-75.6,-66.48,-57.32,-48.2,-39.09,-29.88,-63.81,-54.98,-46.08,-37.
217-28.23,-19.16,-9.69,-41.27,-32.69,-24.04,-15.33,-6.59,-32.86,-
324.95,-16.8,-8.457,-.03691,8.603,-13.09,-5.91,1.75,9.69,17.79,26.1
49,9.652,15.95,22.94,30.41,38.13,46.17,35.18,40.3,46.52,53.41,60.69
5,68.26,63.22,66.87,72.16,78.37,85.15,91.42,93.32,95.24,99.42,104.9
6,111.1,117.9,125.1,125.128,132.6,138.1,144.5,157.6,155.6,157.2,1
760.9,165.8,171.5,129.4,-124.6,-119.8,-115.1,-110.3,-105.5,-100.8,-
896.05,-91.34,-119.2,-114.7,-110.2,-105.6,-101.1,-96.3,-91.67,-87.1-
982.2,-106.6,-102.6,-98.44,-94.16,-89.78,-85.37,-80.89,-76.41/
DATAAE/-71.76,-90.54,-87.48,-84.-80.23,-76.24,-72.14,-67.96,-63.7
1,-59.25,-68.68,-67.95,-65.92,-63.08,59.75,56.15,52.35,-48.43,-4
24.26,-32.29,-40.58,-42.88,-41.92,-39.75,-36.91,-33.71,-30.25,-26.4
35,53.77,-4.132,-11.72,-15.64,-15.62,-14.11,-11.78,-8.972,-5.682,87
4.21,81.4,177.7,75.35,73.9,73.07,72.73,72.75,73.18,73.4,134.3,127.
58,123.1,119.8,117.5,115.9,114.9,114.5,195.7,187.1,178.5,173.1,167.
66,164.4,161.2,159.4,157.6,-15.62,-14.87,-14.11,-12.95,-11.78,-10.3
78,-8.972,-7.402,-5.682,-6.565,-6.265,-5.655,-4.775,-3.705,-2.505,-
81.175,-2448,1.895,3.062,2.942,13.262,3.882,4.732,15.772,16.952,8.262,
99.652,13.25,12.63,12.58,12.91,13.54,14.39,15.42,16.57,18.124,07/
DATAAF/22.85,22.36,22.37,22.74,23.37,24.22,25.22,26.52,35.52,33.58
1,32.6,32.22,32.29,32.69,33.34,34.18,35.18,47.59,44.82,43.26,42.66,
242.19,42.34,42.77,43.42,44.4,160.27,56.56,54.34,53.08,52.45,52.3,5
32.49,52.95,53.76,73.69,68.77,85.85,64.05,63.03,62.55,62.48,62.73,5
43.22,67.21,81.4,77.7,75.35,72.9,73.07,72.73,72.75,73.18,129.2,114
5.2,99.66,87.29,78.08,71.44,66.61,63.01,60.27,156.4,144.8,133.1,121.
67,111.7,103.2,96.55,91.31,87.21,80.2,170.8,161.2,151.6,142.5,134.
1,126.7,120.5,115.2,202.5,194.5,186.2,178.1,170.1,162.4,155.3,149.
8,143.4,223.7,216.6,209.4,202.3,195.3,188.4,181.9,175.8,169.6,124.4,
9238.-231.9,225.9,219.8,213.8,207.8,201.7,195.7,211.5,195.7,177.5/
DATAAG/155.9,129.3,227.2,212.4,196.1,177.5,155.6,242.7,229.2,214.4,
1198.1,180.2,125.8,246.2,232.7,216.1,202.5,275.5,263.3,250.8,237.6,2
223.7,291.5,279.6,267.8,255.9,244.-15.64,-15.86,-15.9,-15.82,-15.6
32.-5.435,-6.025,-6.375,-6.535,-6.565,5.672,4.572,3.83,3.352,3.362
4,17.77,16.14,7.4,13.86,13.25,31.06,28.38,26.46,25.08,24.07,45.63,4
51,77.39,02,37.01,35.52,61.41,56.17,52.41,49.66,47.59,78.08,71.44,6
66.61,63.01,60.27,-11.71,-12.49,-13.15,-13.68,-14.55,-14.93,-14.85,
7-15.11,-15.33,-15.51,-15.64,-5.126,-6.216,-7.106,-7.656,-8.486,-9.
8096,-9.466,-9.836,-10.17,-10.43,-10.57,2.125,6145,-1605,-1.615,-
92.465,-3.185,-3.785,-4.305,-4.745,-5.125,-5.435,-10.25,8.118,4.387/
DATAAH/5.068,3.938,2.998,2.188,1.508,.5279,4.279,9.09789,19.54,16.4
18,14.16,12.31,10.81,9.572,8.522,7.632,6.872,6.222,5.672,30.23,25.9
24,22.69,20.21,18.2,16.59,15.24,14.13,13.12,3.11,7.42,45.36,57.3
32.24,28.86,26.24,24.13,22.4,20.95,19.72,18.67,17.77,56.96,48.75,42
4.76,38.31,3.96,32.25,30.05,28.22,26.68,25.38,24.59,20.87,61.154
5.36,48.72,44.30,40.99,38.21,35.94,34.34,32.43,31.06,82.67,4.366.
63,59.71,54.45,50.25,46.44,42.44,1.8,39.85,38.32,94.5,86.05,78.07,
770.98,65.01,60.09,56.05,52.7,49.95,47.62,45.63,43.9,96.67,89.08,
881.97,75.61,70.16,65.55,61.7,58.46,55.72,53.5,113.3,106.3,95.23,92
9.39,86..80,24.75,23.70,92.67,24.64,1.61,41.2,3.115,1,108.67/
DATAAI/102.1,95.9,90.12,84.88,80.24,76.2,72.769,73,129.2,123.2,11
17.2,111.3,105.4,99.6,94.67,89.7,85.45,81.76,78.08,127.120.2,112.
24,103.5,93.26,81.3,67.73,54.02,43.09,38.2,132.2,125.7,118.5,110.6
3,101.7,91.87,81.31,70.87,148.2,143.6,138.1,132.125.6,118.6,111.10
42.9,94.5,158.5,154.5,149.6,144.3,138.7,133.,126.7,120.2,113.3,168.

```



```

COMMON/ETENTHAL/H(1183)
DATA(M(I),I=1,177,194)=171.5,198.4,228.3,263.6,285.9,313.1,352.7,37
10.5,395.2,436.4,450.7,472.9,514.8,526.7,547.5,568.5,598.9,616.3)
DATA(M(I),I=187,891)=127.1,120.2,112.4,103.5,93.2,81.3,67.3,54.0
12.4,3.09,130.2,32.5,125.7,110.5,110.6,101.7,91.87,81.31,70.87,148.
25.14,3.6,136.1,132.1,125.6,118.6,111.1,102.9,94.5,158.5,154.5,149.6,14
36.3,138.7,133.1,126.7,120.2,113.3,168.9,164.5,160.2,155.9,150.5,145
4.2,139.9,134.6,129.2)
DATA(M(I),I=892,995)=79.93,66.59,11.4,3.918,5075,-1.802,-3.602,
1-5.052,-6.252,-7.272,-8.152,-8.922,-9.812,-10.22,-10.77,-11.27,-11
2.71,90.02,83.58,73.25,54.98,21.88,12.66,8.264,5.374,3.244,1.524,-1
314.3,-1.086,-2.106,-3.006,-3.796,-4.496,-5.126,100.2,94.23,87.36,78
4.83,67.23,49.08,29.54,20.61,15.97,12.63,10.13,8.165,6.575,5.205,4.
5035,3.025,2.125,1.07,3.102,0.97,34.91,12.83,6.74,82.63,27.48,88.36.
62.28,22.23,17.19,7.9,17.04,14.65,13.06,11.56,10.25,11.4,5.110,3.105,
77.100,6.94,95.68,54.81,12.72,37.62,11.51,17.43,89.34,99.30,1.26,47
8.23,81.21,48.19,54.12,0.71,117.1,113.1,108.7,104.9,98.79,93.87,86.68,
979.5,71.49,62.88,54.41,7.13,41.26,36.7,33.11,30.23,126.8,123.4,
DATA(M(I),I=996,1027)=119.8,116.1,111.9,107.4,102.7,97.52,91.9,85.
177,79.12,72.07,64.9,58.08,52.1,47.03,42.85,132.6,129.4,126.1,122.6
2.119,115.1,111.1,106.5,101.9,96.67,91.49,85.64,79.78,73.71,67.65,62
3.3,56.96)
DATA(M(I),I=1028,1072)=71.06,37.36,.06246,.06246,.06246,84.65,57.
165,.3469,.3469,.3469,98.79,74.09,44.19,1.186,1.186,1.186,113.8,92.74,64.
294,2.945,2.945,130.3,113.5,89.33,54.05,6.054,148.2,134.2,116.6,91.
372,10.72,167.6,155.9,142.1,125.6,103.1,109.1,178.5,166.9,153.8,138.2,
4211.5,202.1,192.1,181.1,160.9)
DATA(M(I),I=1073,1102)=87.79,71.29,54.39,8.994,8.994,100.5,89.02,
171.72,52.63,39.82,111.5,102.8,91.55,72.40,44.51,121.5,114.3,105.9,
295.3,79.97,131.1,128.9,117.9,109.9,100.2,3134.7,128.7,122.1,
314.5)
DATA(M(I),I=682,783)=-11.71,-12.49,-13.15,-13.60,-14.15,-14.53,-1
14.95,-15.11,-15.33,-15.51,-15.64,-15.126,-6.216,7.106,7.856,-8.48
26.9,0.06,-9.466,-9.836,-10.17,-10.43,-10.57,2.125,6.148,-6.052,-1.
3615,-2.465,-3.185,-3.785,-4.305,-4.745,-5.125,-5.435,10.25,118.6
4.438,5.068,3.938,2.998,2.188,1.508,9279.4279,-.09789,19.54,16.48,
514.16,12.31,10.81,9.572,8.522,7.632,6.872,6.222,5.672,30.23,25.94,
622.69,28.21,18.22,16.59,15.24,14.13,13.12,12.31,7.142,85.36,57.32,
724.28,86.26,24.24,13.22,4.20,95.19,72.18,67.17,56.98,48.75,42.7
46.38,31.3,96.32,25.30,05.28,22.66,25.38,24.39,70.87,61.71,54.3
96.48,72.44,36.40,99.38,21.35,94.34,04.32,43.31,06.62,67.4,3.66,3)
DATA(M(I),I=784,846)=59.71,54.45,50.25,46.87,44.12,41.8,39.85,38.
132,94.5,86.05,78.07,78.98,65.01,60.09,56.05,52.73,49.95,47.62,45.6
23,103.9,96.67,89.08,81.97,75.61,70.16,65.55,61.7,58.46,55.72,53.3
3113.3,106.3,99.23,92.39,86.80,24.75,23.70,92.67,24.64,1.61,41.121
4.3,115.1,108.6,102.1,95.9,90.42,84.86,80.24,76.72,73.69,73,129.2,
5123.2,117.2,111.3,105.4,99.6,94.67,89.75,85.45,81.76,78.08)
DATA(M(I),I=642,681)=-15.64,-15.86,-15.9,-15.82,-15.62,-5.435,-6.
1025,-6.375,-6.535,-6.565,5.672,4.572,3.832,3.352,3.062,17.77,16.1
24.74,13.86,13.25,31.06,28.38,26.46,25.08,24.07,45.63,41.77,39.82,3
37.01,35.52,61.41,56.17,52.41,49.66,47.59,78.08,71.44,66.61,63.01,6
40.27)
END
SUBROUTINE ETNDATA2
COMMON/ETENTHAL/H(1183)
DATA(M(I),I=195,230)=157.6,155.6,157.2,160.9,155.8,171.5,266.1,25
10.9,256.6,257.2,259.8,263.6,364.1,355.6,351.2,349.6,350.5,352.7,45

```

```

20.6,442.7,437.8,435.6,435.3,436.4,528.3,521.6,517.2,514.8,514.1,51
34.601.3,594.3,592.4,590.4,588.4,586.5)
DATA(M(I),I=231,260)=195.7,178.5,161.2,157.6,305.6,292.1,28
10.9,272.4,266.1,396.9,386.7,377.8,370.2,364.1,476.7,469.4,462.1,455
28,450.6,548.9,542.8,537.4,532.5,528.3,618.3,614.4,609.8,605.5,601.3
3)
DATA(M(I),I=261,270)=291.5,244.4,195.7,370.6,337.4,305.6,445.1,420
1.3,396.9,514.4,494.3,476.7,578.5,562.7,548.9,635.3,626.8,618.3)
DATA(M(I),I=271,305)=36.36,-4208.35,79,-23.08,12.56,47.71,-6.59
1.28,33,62.96,14.03,48.09,82.13,39.11,72.05,105.4,60.26,99.93,132.5
2,100.7,130.9,162.7,135.4,164.1,194.9,171.5,198.4,228.3)
DATA(M(I),I=306,377)=85.42,-76.04,-66.75,-57.54,-48.41,-39.52,-7
15.6,-66.48,-57.32,-48.2,-39.09,-29.88,-63.81,-54.98,-46.08,-37.17,
2-28,23,-19.16,-49.69,-41.27,-32.69,-24.04,-15.33,-6.59,-32.86,-24,
395,-16.8,-8.457,-0.3691,0.603,-13.09,-5.91,1.75,9.69,17.79,26.19,9
4,652.15,95.22,94,30.41,38.13,46.17,35.10,40.3,46.52,53.4,60.69,68
5,26,83,22,66,87,72,16,78,37,85,15,91,42,93,32,95,24,99,42,104,9,11
61.1,117.9,125.1,125.1,125.1,125.1,132.6,138.1,144.5,157.6,155.6,157.2,160.
79,165.3,171.5)
DATA(M(I),I=378,440)=-129.4,-124.6,-119.8,-115,-110.3,-105.5,-10
10.8,-95.05,-91.34,-119.2,-114.7,-110.2,-105.6,-101.1,-96.3,-91.67,-
207,-82.2,-106.6,-102.6,-98.44,-94.16,-89.78,-85.37,-80.09,-76.41,
3-71.76,-90.94,-87.48,-84,-80.23,-76.24,-72.14,-67.96,-63.7,-59.25
4,-68.68,-67.95,-65.92,-63.08,-59.75,-56.15,-52.35,-48.43,-44.26,-3
52,29,-40.58,-42.88,-41.92,-39.75,-36.91,-33.71,-30.25,-26.45,53.77
6,-4.132,-11.72,-15.64,-15.62,-14.11,-11.78,-0.972,-5.682)
DATA(M(I),I=441,467)=87.21,81.41,77.75,35,73.9,73.07,72.73,72.7
15,73.18,143.4,34.3,127.8,123.1,119.8,117.5,115.9,114.9,114.5,195.
2,187.1,178.5,173.1,167.6,164.4,161.2,159.4,157.6)
DATA(M(I),I=468,611)=129.2,114.2,99.6,87.29,78.08,71.44,66.61,63.
101,60.27,156.4,144.8,133.1,121.7,111.7,103.2,96.55,91.31,87.21,180
2,2,170.8,161.2,151.6,142.5,134.1,128.7,120.5,115.2,104.5,186
3,2,178.1,170.1,162.4,155.3,149.1,143.4,123.7,216.6,209.4,202.3,195.
4,168.4,161.9,175.8,169.6,244.4,238.1,231.9,225.9,219.8,213.8,207.8,
5281.7,195.7)
DATA(M(I),I=612,641)=211.5,195.7,177.5,155.9,129.3,227.2,212.4,196
1.1,177.5,156.4,242.7,229.2,214.4,198.1,180.2,258.8,246.2,232.7,218
2.1,202.5,275.2,263.3,250.8,237.6,223.7,229.1,5,279.6,267.8,255.9,244.
3)
END

```

```

FUNCTION ETDEMS(PRES,TEMP)
COMMON/EDENSITY/R(886)
DATA(IR(I),I=1,107)=0.000376,0.007052,0.006114,0.005412,0.004862,0

```

```

FUNCTION ETDEMS(PRES,TEMP)
DIMENSION PS(20),TS(20),JP(28),MX(28),LOC(30),BP(28),DP(28),BT(30)
1,OT(28),R(886)

```

```

I=F
IF(I.GT.8) I=8
F=F-I
FP=1.0-F
TQ=FP*TL(I+1)+F*TL(I+2)
IF(T.GE.TQ) GO TO 33
ETENTH=FP*HS(I+1)+F*HS(I+2)
RETURN
33 IF(T.LT.5000.)NI=N
FP=(P-BP(N))/DP(N)
IP=FP
IF(IP.GT.MX(N)) IP=MX(N)
F=FP-IP
FP=1.0-F
FI=(1-BT(N1))/DT(N)
IT=FI
FF=FI-IT
FI=1.0-FF
I=IT*JP(N)+IP+LOC(N1)
J=I+JP(N)
ETENTH=FP*FT*H(I)+F*FT*H(I+1)+FP*FF*H(J)+F*FF*H(J+1)
RETURN
END

```



```

7 N=8
  M1=29
  GO TO 23
8 I=24,64,0.00317*P
  IF(I.LT.12) I=12
  IF(P.LT.161.76) GO TO 11
  IF(P.LT.164.28) GO TO 9
  N=9
  GO TO 33
9 IF(P.LT.1469.6) GO TO 10
  N=10
  GO TO 33
10 N=11
  GO TO 33
11 IF(I.GE.59.4) GO TO 14
  N=12
  IF(P.GE.187.6385) GO TO 33
  DO 12 I=2,20
  IF(P-PS(I)) 13,13,12
12 CONTINUE
13 I=20
  IF(TS(I-1)+(TS(I)-TS(I-1))*(P-PS(I-1))/(PS(I)-PS(I-1))
  IF(I.GE.7M) GO TO 24
  GO TO 33
14 IF(I.LT.108.0) GO TO 16
  IF(P.LT.132.264) GO TO 15
  N=13
  GO TO 33
15 N=14
  GO TO 33
16 IF(P.LT.587.84) GO TO 17
  N=15
  GO TO 33
17 IF(I.LT.72.0) GO TO 23
  IF(I.LT.86.4) GO TO 20
  IF(P.LT.293.92) GO TO 18
  N=16
  GO TO 33
18 IF(P.LT.73.48) GO TO 19
  N=17
  GO TO 33
19 N=18
  GO TO 33
20 IF(P.LT.293.92) GO TO 21
  N=19
  GO TO 33
21 IF(P.LT.36.74) GO TO 22
  N=20
  GO TO 33
22 N=21
  GO TO 33
23 IF(P.LT.293.92) GO TO 24
  N=22
  GO TO 33
24 IF(P.LT.180.0) GO TO 25
  N=23
  GO TO 33
25 IF(P.GE.29.0) GO TO 27

```



```

IF(P.LT.2.9392) GO TO 26
N=24
GO TO 33
26 N=25
GO TO 33
27 IF(T.GE.64.8) GO TO 29
IF(P.GE.102.0) GO TO 28
N=26
GO TO 33
28 N=27
GO TO 33
29 N=28
33 IF(T.LE.5000.0) N1=N
FP=(P-8P(N1))/OP(N)
IP=FP
IF(IP.GT.MX(N)) IP=MX(N)
FP=FP-IP
FP=1.0-F
FT=(T-8T(N1))/DT(N)
IT=FT
FF=FT-IT
FT=1.0-FF
I=IT*JP(N)+IP*LOC(N1)
J=I*JP(N)
ETDMS=FP*FT*R(I)+F*FT*R(I+1)+FP*FF*R(J)+F*FF*R(J+1)
RETURN
END

```

```

SUBROUTINE EDATADEN
COMMON/EDENITY/R(806)
DATA(R(I),I=100,202)=.9949,.00341,.3021,.5025,.8432,.0026,.2601,.
15036,.7325,.002,.2205,.4441,.6479,.00161,.2037,.3972,.581,.00131,.
21036,.3592,.5267,.0011,.167,.3279,.4010,.009,.1536,.3017,.4439,.
30027,.1422,.2793,.4116,.0,.01445,.0,.01252,.0,.01105,.0,.009892,0
4,.008951,0,.008174,0,.007521,.000267,.1422,.2793,.4116,.000189,
5.1235,.2432,.3592,.000144,.1092,.2154,.3187,.00012,.09785,.1933,.2
6464,9.6E-5,.08064,.1753,.2601,8.1E-5,.08101,.1604,.2382,6.9E-5,.07
7459,.1478,.2186,.000309,.0002256,.0007521,.000251,.0001882,.000
86272,-.000215,.0001611,.0005373,-.0001876,.0001402,.0004686,-.0001
9656,.0001221,.0004119,-.0001452,.0001042,.0003599,6.9E-6,.07459)
DATA(R(I),I=203,307)=.1478,.2196,.46E-6,.06226,.1236,.1839,3.1E-6
1,.93342,.1061,.1502,9.7E-7,.0477,.09301,.1307,.3.6E-6,.04155,.0827
22,.1235,-.1.32E-5,.0373,.07436,.1111,5.27,5.489,5.68,4.501,8.45,5.
3107,3.8164,.126,.4483,2.857,3.466,3.895,2.319,2.935,3.395,4.984,5.
4145,5.27,.4.533,4.743,4.886,3.958,4.274,4.501,3.307,3.752,4.059,4.2.69
58,3.243,3.616,2.226,2.796,3.236,1.886,2.435,2.857,1.639,2.15,2.588
6,1.453,1.924,2.319,5.033,5.112,5.183,.816,4.914,994,4.558,4.676,
74.764,4.248,4.405,4.533,3.88,4.094,4.246,3.442,3.743,3.958,2.953,3
8.361,3.633,2.481,2.975,3.307,2.093,2.616,3.002,1.80,2.309,2.598,1
9.588,2.059,2.462,1.423,1.856,2.226,1.293,1.691,2.056,1.187,1.555)
DATA(R(I),I=308,411)=1.886,1.1,1.441,1.754,1.026,1.344,1.639,962
17.1.262,1.546,9076,1.189,1.453,4.742,4.853,6.946,5.031,4.43,4.584
24.709,4.816,4.024,4.279,4.417,4.558,3.165,3.778,4.05,4.248,1.43,2
3.988,3.595,3.88,-.0233,5581,1.189,1.804,-.015,503,1.05,1.588,-.0
4099,4.931,1.945,1.423,-.0065,1.423,1.8618,1.299,-.0042,3928,7943,1
5.187,-.0025,3669,7379,1.1,-.0015,3445,6888,1.026,-.0007,3249,
6.6483,.9627,-.0001,3075,.612,.9076,-.07704,.02568,.1307,.2384,-.0
76786,.02262,.114,2079,-.08066,.02022,.1018,.1844,-.05484,.01828,

```

```

8.09179,.1659,.05004,.01668,.0836,.1508,.04602,.01534,.07677,.138
93.3.087,3.988,4.105,3.447,3.646,3.792,2.91,3.226,3.442,2.323,2.76)
DATA(R(1),1.541,5.15)=3.051,1.057,2.317,2.67,1.549,1.963,2.326,1.3
14.1.701,2.035,1.109,1.497,1.804,.7859,1.309,1.857,.6864,1.106,1.154
29.6141,.9689,1.34,.5581,.8735,1.189,1.675,.3524,.5577,.7859,1.153,
3.3178,.4955,.6064,1.409,.2902,2.4479,.6141,1.1307,.2674,.4127,.5581,
4.03228,.03224,.09058,.1675,-.02974,.02971,.09043,.153,-.02756,.02
574,.08359,1.409,-.02568,.02568,.07819,1.1307,1.226,1.807,2.329,2.6
674,2.911,0.52,1.481,1.941,2.326,2.616,.9378,1.279,1.656,2.019,2.32
73,.0526,1.141,1.456,1.774,2.089,.7859,1.047,1.309,1.583,1.857,.099
875,.2084,.3279,.461,.6115,.7847,.9864,1.226,.09478,.1962,.3063,.42
964,.5585,.7052,.8693,1.052,.08981,.1855,.2878,.3977,.5164,.6451)
END

SUBROUTINE EDATDENI
COMMON/EDENSITY/R(806)
DATA(R(1),1.516,6.201)=.7851,.9388,.0859,.176,.2717,.3734,.4817,.59
172,.7207,.8526,.08199,.1675,.2599,.3524,.4555,.5577,.6718,.7859,-.0
21936,.01932,.05885,.09975,-.01756,.01753,.05323,.08981,-.01615,.01
3611,.04882,.08199,3.304,3.422,3.541,3.659,3.777,3.044,3.243,3.45,3.
4572,3.687,2.74,3.102,3.384,3.449,3.557,2.822,2.88,3.141,3.315,3.44
57,1.861,2.621,2.959,3.17,3.313,1.551,2.329,2.76,3.014,3.179,1.358,
62.045,2.546,2.848,3.044,1.226,1.807,2.329,2.674,2.91,6.295,2.42,2.
726,2.849,2.937,3.005,3.061,3.113,3.153,3.191,3.227,3.259,.9338,1.0
876,1.265,1.599,2.202,2.506,2.65,2.768,2.85,2.919,2.976,3.026,.629
97,.9234,1.03,1.159,1.322,1.542,1.835,2.136,2.356,2.509,2.618)
DATA(R(1),1.621,7.22)=2.709,.759,.8323,.9121,1.001,1.103,1.221,1.35
19,1.523,1.713,1.916,2.106,2.267,.7053,.767,.8326,.9039,.9807,1.066
2.116,1.265,1.383,1.513,1.655,1.803,.6621,1.716,1.7728,.8331,.8976,
3.9656,1.04,1.12,1.206,1.299,1.4,1.507,.6259,.6745,.725,778,.8337,
4.8927,.9537,1.019,1.089,1.163,1.242,1.325,.5941,.6412,.6883,.7355,
5.7826,.8372,.8921,.9469,1.005,1.07,1.135,1.2,-.000743,.04849,.085
64,0.0,-.000787,.04023,.08466,.1315,.1915,-.000437,.03393,.07032,
7.1897,.1534,-.000257,.02944,.06027,.09278,.1275,-.000177,.02599,.0
95289,.0808,.1098,-.000122,.0233,.0472,.07177,.09714,-8.3E-5,.02112
DATA(R(1),1.723,8.27)=.01172,.02363,-.000111,.009736,.019,-5.9E-5
1.008154,.01648,-3.6E-5,.007021,.01444,-2.4E-5,.006166,.0124,-1.5E
2-5,.005498,.01104,-1.1E-5,.004962,.009954,-9.E-6,.004521,.009063,-
37.E-6,.004153,.008321,-2.2E-5,.003846,.007715,.1664,2.48,0.0,.08,
40,.1469,.2418,.3397,0.0,0.0,.1315,.2117,.3091,4.233,.5318,0.0,.11
595,.1891,.2684,.3626,.4611,.5115,1.098,1.171,24,.3166,.4051,.5124
6.1.1017,.1578,.2183,.2841,.3568,.4387,.09486,.1463,2.009,.2592,.322
7.3903,.08892,.1377,.1865,.2407,.295,.3365,.3712,.727,.9725,0.0,.
80,.5124,.6559,.8514,1.116,0.0,.4755,.5827,.7329,.9604,1.252,1.7
918,.4387,.5353,.6477,.7994,1.068,1.534,.4145,.4956,.5914,.706)
DATA(R(1),1.828,9.886)=.0535,1.082,.3903,.4653,.5491,.6447,.7575,.8
1985,.3734,.4399,.5151,.5986,.6928,.802,.3585,.4181,.4898,.5616,.64
287,.7352,.08892,.1865,.295,.4181,.5616,.7358,.08373,.1743,.2731,.3
3822,.504,.6439,.07931,.1549,.2562,.3545,.461,.814,-1.32E-5,.0373
4,.07436,.111,-2.97E-5,.0337,.06734,.1007,-5.14E-5,.03051,.06122,0
59175,-.0001453,-.001042,.0003599,-.000124,8.541E-5,.0003076,-9.95E
6-5,6.714E-5,.0002542)
END

```

```

GO TO 33
18 IF(P.LT.73.48) GO TO 19
N=17
GO TO 33
N=18
GO TO 33
N=19
IF(P.LT.293.92) GO TO 21
GO TO 33
N=20
21 IF(P.LT.36.74) GO TO 22
GO TO 33
N=21
GO TO 33
N=22
23 IF(P.LT.293.92) GO TO 24
GO TO 33
N=23
24 IF(P.LT.180.0) GO TO 25
GO TO 33
N=24
25 IF(P.LT.29.0) GO TO 27
IF(P.LT.2.9392) GO TO 26
GO TO 33
N=25
GO TO 33
27 IF(T.GE.64.8) GO TO 29
IF(P.GE.102.0) GO TO 28
N=26
GO TO 33
N=27
GO TO 33
N=28
29 IF(T.LE.5000.0)N1=N
FP=(P-BP(N))/OP(N)
IF=FP
IF(IP.GT.MX(N)) IP=MX(N)
F=FP-IP
FP=1.0-F
FT=(1-BT(N1))/OT(N)
IT=FT
FF=FT-IT
FT=1.0-FF
J=IT*JP(N)+IP*LOC(N1)
J=I+JP(N)
ETDENS=FP*FT*R(I)+F*FT*R(I+1)+FP*FF*R(J)+F*FF*R(J+1)
RETURN
END

```

2

30



```

18 IF(P.LT.734.8) GO TO 20
   IF(P.LT.1763.52) GO TO 19
   N=13
   GO TO 33
19 N=14
   GO TO 33
20 IF(T.LT.90.) GO TO 23
   IF(P.GE.67.16) GO TO 22
   IF(P.LT.6.716) GO TO 21
   N=16
   GO TO 33
21 N=17
   GO TO 33
22 N=15
   GO TO 33
23 IF(P.LT.183.7) GO TO 28
   IF(P.LT.440.88) GO TO 24
   N=19
   GO TO 33
24 IF(T.LT.68.4) GO TO 25
   N=28
   GO TO 33
25 IF(P.LT.257.18) GO TO 26
   N=21
   GO TO 33
26 IF(T.LT.63) GO TO 27
   N=22
   GO TO 33
27 N=23
   GO TO 33
28 IF(P.LT.6.716) GO TO 30
   IF(P.LT.48.5) GO TO 29
   N=24
   GO TO 33
29 N=25
   GO TO 33
30 N=26
   GO TO 33
33 IF(T.LE.5000.)MI=M
   FP=(P-8P(N))/OP(N)
   LP=FP
   IF(IP.GT.MX(N)) IP=MX(N)
   F=FP-IP
   FP=1.0-F
   FT=(1-8T(N1))/OT(N)
   IT=FT
   FF=FT-IT
   FT=1.0-FF
   I=IT*JP(N)+IP+LOC(N1)
   J=I+JP(N)
   ETENR=FP*FT*S(I)+F*FT*S(I+1)+FP*FF*S(J)+F*FF*S(J+1)
   RETURN
   ENO

SUBROUTINE ETSDATA
COMMON/ETENROP/S(1748)
DATA(S(1),I=325,432)=8.82,8.635,8.45,9.655,8.115,7.24,6.635,6.168
15.8,10.46,8.982,8.187,7.676,7.286,6.974,11.08,9.653,8.895,8.423,
28.07,7.86,11.6,10.18,9.447,8.995,8.662,8.397,12.03,10.62,9.895,9.

IF(P.LT.35.3) GO TO 6
IF(P.LT.353.) GO TO 5
N=5
GO TO 33
5 N=6
GO TO 33
6 IF(P.LT.3.53) GO TO 7
N=7
GO TO 33
7 N=8
GO TO 33
8 IF(P.LT.35.3) GO TO 10
IF(P.LT.353.) GO TO 9
N=9
GO TO 33
9 N=10
GO TO 33
10 IF(P.LT.3.53) GO TO 11
N=11
GO TO 33
11 N=12
GO TO 33
12 IF(T.GE.59.4) GO TO 18
TZ=24.84+0.00317*P
IF(T.LT.12) Y=12
IF(P.LT.1763.52) GO TO 14
N=13
GO TO 33
14 IF(P.LT.734.8) GO TO 15
N=14
GO TO 33
15 N=18
IF(P.GE.187.6385) GO TO 33
DO 16 I=2,20
IF(P-PS(I))17,17,16
16 CONTINUE
I=20
17 TZ=TS(I-1)+(TS(I)-TS(I-1))*(P-PS(I-1))/(PS(I)-PS(I-1))
IF(T.LT.12) GO TO 33
GO TO 28
18 IF(P.LT.734.8) GO TO 20
IF(P.LT.1763.52) GO TO 19
N=13
GO TO 33
19 N=14
GO TO 33
20 IF(T.LT.90.) GO TO 23
IF(P.GE.67.16) GO TO 22
IF(P.LT.6.716) GO TO 21
N=16
GO TO 33
21 N=17
GO TO 33
22 N=15
GO TO 33
23 IF(P.LT.183.7) GO TO 28
IF(P.LT.440.88) GO TO 24
N=19

```

```

FUNCTION ETCOND (PRES,TEMP)
DIMENSION PS(19), TS(19), JP(19), MX(19), LOC(19), 8P(19), DP(19), 8T(19)
      OT(19)
COMMON/EINBDA/C(738)
DATA JP=7,5,3,6,3,6,6,7,5,5,5,5,2,5,4,3,3,3
DATA INX=3,4,4,1,4,5,3,7,3,0,3,2,1,1,1
DATA LOC=1,79,123,160,204,236,251,261,329,332,417,442,487,512,524,
      584,668,689,710
DATA TOP=52,780,2500,0,100,142,5,107,5,107,5,400,700,0,0,,
      0,0,1,0,0,0,-100,0,0,
DATA TOP=100,450,1250,20,30,22,5,42,5,50,450,175,625,,
      1250,3000,1,10,40,300,1500,
DATA BOT=26,28,30,25,52,56,56,59,56,60,100,100,100,500,
      3000,3000,3000,3000,3000,

```

```

FUNCTION ETCOND(PRES,TEMP)
DIMENSION PS(19),TS(19),JP(19),MX(19),LOC(19),8P(19),DP(19),8T(19)
DIMENSION DT(19),C(730)
DIMENSION AA( 94),AB(102),AC(113),AD( 97),AE( 95),AF(110),AG(111)
      I,AH1= 8
      EQUIVALENCE( C,AA), ( C( 95),AB), ( C( 197),AC), ( C( 310),AD)
      , ( C( 407),AE), ( C( 502),AF), ( C( 512),AG), ( C( 723),AH)
      DATA AA(.05628,.04628,.04702,.04764,.04823,.0488,.05238,.052
      996,.05333,.05392,.05408,.05502,.05554,.0554,.05631,.05716,.05797,
      05805,05873,.05946,.06016,.06088,.05811,.05917,.06016,.0611,.06199,.0628
      4,.05866,.06026,.06155,.06275,.06388,.06495,.06597,.05975,.06147,.
      06302,.06444,.06577,.06702,.06819,.05959,.06173,.06359,.06527,.066
      861,.06824,.06988,.05844,.06116,.06343,.06542,.0672,.06883,.07035,
      06961,.06828,.06268,.06505,.06713,.06899,.07069,.05203,.05075,.05134
      )

```

DATA(01=3,4,5,11,4,1,3,3,3,10,5,20,80,500,200,200,1  
1 500,500,500.)  
DATA(P3=1,022,2,0,4,0,0,0,1,0,25,0,4,3,0,69,0,99,0,128,0,451,0,  
1165,0,176,0,182,0,185,0,186,5,187,25,187,468,75,187,506)  
DATA(T5=2,845,27,07,29,81,33,07,36,18,39,96,44,12,48,33,51,97,  
154,79,56,72,57,80,58,57,50,99,59,18,59,29,59,34,59,353,59,356)  
DATA(C111,1=1,92)=04565,04628,04642,04702,04764,04823,048  
18,05238,05286,05333,05392,05448,05502,05554,05594,05633,0  
25716,05737,05873,05946,06016,06098,06111,05917,06016,0611  
3,06199,06288,06386,06486,06577,06672,06702,06819,05959,06173,0635  
59,06527,06681,06824,06958,05844,06116,06343,06542,0672,0  
68833,07035,0562,05982,06268,06505,06713,06899,07069,05203  
7,0575,06134,06425,06669,06882,07074,05495,05435,05902,06  
8276,06566,06812,07028,05332,05581,05809,06037,0,06016,06  
9281,06516,06735,06959,06391,06733,07034,07306,07537)  
DATA(C11,1=93,192)=06755,07175,07539,07867,08167,06958,07  
1451,07872,08247,08589,0705,07615,08088,08505,08883,07875,  
2,07717,0824,08695,09105,07028,0775,0832,08809,09244,06905,  
3,07716,08331,08849,09306,06716,07088,0,07386,08031,08755,  
4,08167,08906,09571,08673,09533,1028,09001,09956,1078,082  
523,1025,1114,09306,1039,1131,09345,1047,1142,09343,1051,  
6,1148,09309,1051,115,0924,1047,1147,09147,1039,114,0902  
77,1029,113,08889,1016,1118,08736,1002,1103,08717,0878,0  
8,0,0,0,09233,01023,01208,01376,0,0,01363,01425,0151,  
9,0161,0179,0215,01987,02032,02086,0215,02223,02333,02637)  
DATA(C11,1=193,299)=02676,02719,02767,02819,02877,03212,0  
13247,03264,03364,03408,1604,0831,0807,0,02525,1540,  
2,0602,1280,3682,2586,1448,02011,5029,3803,2607,1391,655  
35,5233,3942,2888,8239,6804,5439,4114,1,006,8531,7083,568  
47,1199,1,837,8847,7385,2036,1996,1846,1577,1463,129,1231  
5,1800,0,07479,0,1091,02269,0,1181,0,0009,1805,5482,932  
6,1,317,1,704,2,09,0225,3633,7102,1,082,1,459,1,839,009368,244  
79,5332,0780,1,232,1,589,09658,1137,3767,6808,1,023,1,371,0  
8,0,0,0,0893,4863,8152,1,153,0016,1424,0,0,0391,5938,9398,08  
9608,5947,454,4618,0,0,1801,2459,3842,51,6221,0,0,2783)  
PAPRES  
IF(P.LT.1.0) P=1.0  
I=TEMP  
IF(I.EE.5000,1) I=5999,9999  
DIV=1.0  
I2=24,84,00317\*P  
IF(I.LT.1.0) I=I2  
IF(I.LT.1.0) GO TO 4  
IF(I.EE.700,0) GO TO 3  
IF(I.LT.187,506) GO TO 7  
IF(I.LT.56,0) GO TO 12  
IF(I.EE.400,0) GO TO 2  
I4=(-0.0000523467\*P+0.08698291)\*P+44.882441  
IF(I.EE.1M) GO TO 1  
M=7  
DIV=(P-187.506)\*.083+TM-T  
GO TO 33  
1 M=8  
DIV=(P-107.506)\*.083+T-TM  
GO TO 33  
2 M=9

7,06425,06669,06882,07074,05495,05435,05902,06276,06566,0  
86812,07028,05332,05581,05804,06097,0,0,06016,06281,06516,0  
96359,06999,06991,06733,07034,07306,07557,06755,07175/  
DATAAB/07533,07867,08167,06958,07451,07872,08247,08589,07  
105,07615,08088,08505,08883,07075,07717,0824,08695,09105,  
207028,0775,0832,08809,09244,06905,07716,08331,08849,09306  
3,06716,07088,0,07386,03051,08755,08167,08906,09571,08673  
4,09533,1028,09001,09956,1078,09223,1025,1114,09306,1039,  
5,1131,09345,1047,1142,09343,1051,1148,09309,1051,115,092  
641,1047,1147,09147,1039,114,0902,1029,113,08889,1016,1  
7118,08736,1002,1103,00717,0078,0,0,0,0,09233,01023,01  
8208,01376,0,0,01363,01425,01514,016,0179,0214,01987,02  
902,02086,0215,02223,02333,02637,02676,02719,02767,02819/  
DATAAC/02877,03212,03247,03284,03323,03364,03408,1604,083  
11,0007,0,0,252,154,0602,12,3682,2566,1448,02011,5029,3  
2803,2607,1391,6555,5223,3942,268,8239,6804,5439,4114,1,0  
308,8531,7083,5607,1199,1,037,8847,7385,2036,1996,1846,15  
477,1463,129,1,31,1,704,2,09,0225,3633,7102,1,082,1,459,1,839  
55,5482,9326,1,317,1,704,2,09,0225,3633,7102,1,082,1,459,1,839  
6,009368,2449,5332,8788,1,232,1,589,09658,1137,3767,6808,1  
7,023,1,371,0,0,0,2093,4863,8152,1,153,0016,1424,0,0,2391,59  
838,9358,086,1947,454,461,0,0,1801,2459,3842,51,6221,0,  
9,2783,3339,4294,563,693,824,3848,4405,5207,6309,7636/  
DATAAD/9079,4997,5553,6299,7288,8536,9969,6219,6783,7511  
1,8433,958,1,094,7508,008,8807,9696,1,078,1,207,06345,0648  
2,06605,0672,06829,06931,07028,06142,06308,06456,06591,06  
3715,06831,0694,059,0609,06271,06431,06575,06707,0683,057  
426,05909,06074,06238,06407,06559,06689,05507,05724,05317,  
5,0609,06244,0639,06548,0621,05503,05732,05931,06108,0626  
6,0841,0,0542,05256,05531,05759,05956,06133,06293,06489,  
75033,0532,05582,05799,05991,06164,04584,04878,05162,054  
819,05647,0585,0603,06905,07716,02331,08849,09306,06451,  
90753,08251,08838,09343,06046,0724,0805,08698,09241/  
DATAAE/05677,06965,07764,08456,09027,05479,06618,07469,08  
115,08736,03212,03576,04274,05294,06034,0343,03781,04321,  
205109,05833,03616,03939,04405,05024,05672,03773,04073,044  
378,04994,05557,03901,04183,04544,04989,05479,03902,05246,  
4,06828,07893,08736,09423,1002,1055,1103,04248,052,0634,  
57368,08159,08838,0943,09956,1044,04416,05155,06038,06889,  
6,07633,08278,08846,09354,09819,04606,05256,05992,06724,07  
7398,08003,08547,09042,09498,0479,05376,06016,06659,07267,  
8,07829,08345,0882,09261,0479,06017,07267,08345,09261,0595  
9,06942,07873,08732,09526,07385,08069,08691,09278,09839/  
DATAAF/08811,09256,0965,1003,104,1014,104,1063,1084,1107  
1,1014,1071,1661,1576,2217,2042,2777,3361,3354,4107  
2,3942,4107,4058,4036,4023,4014,4607,4479,4423,4369,4366  
3,5407,5113,4982,4905,4851,6737,6121,5848,5685,5574,4899  
4,7742,7215,69,6685,1,242,1,029,9339,8773,8385,1,772,1,414,1  
5,254,1,158,1,093,2,538,1,973,1,718,1,565,1,46,3,585,2,766,2,363,2  
6131,1,972,4,93,3,763,3,219,2,886,2,656,6,529,5,025,2,296,3,84,3,5  
731,2,41,6,48,5,581,5,006,6,998,9,96,8,013,6,995,6,318,5,825,10  
803,9,406,8,404,7,685,7,4,11,10,37,9,586,8,934,8,402,10,22,10,65,  
910,31,9,864,9,436,4036,3992,3976,3969,4423,4309,4268,425/  
DATAAG/4983,472,4627,4585,585,5298,5102,5016,7219,6151,  
15773,5605,9349,7422,6739,6436,1,256,923,8132,7616,1,723,1  
2,198,1,011,9272,2,373,1,571,1,283,1,159,3,239,2,073,1,651,46,4,3  
34,2722,2,128,1,059,5,665,5,531,2,73,2,363,7,155,4,495,3,463,2,981  
4,8,689,5,591,4,324,3,717,10,05,6,75,5,285,4,554,10,99,7,886,6,309,

```

GO TO 33
3 N=11
GO TO 33
4 IF(P-GE.2500.0) GO TO 6
IF(T-GE.60.0) GO TO 5
N=2
GO TO 33
5 N=10
GO TO 33
6 N=3
GO TO 33
7 DO 8 I=2,19
IF(P-PS(I)) 10,9,8
9 CONTINUE
9 TM=TS(I)
GO TO 11
10 TM=TS(I-1)+(TS(I)-TS(I-1))*(P-PS(I-1))/(PS(I)-PS(I-1))
11 IF(T-GE.TM) GO TO 13
IF(T-LT.56.0) GO TO 12
N=6
DIV=(187.506-P)*.083*TM-T
GO TO 33
12 N=1
GO TO 33
13 IF(P-GE.100.0) GO TO 14
N=4
GO TO 33
14 N=5
DIV=(187.506-P)*.083*TM-T
GO TO 33
15 IF(T-GE.3000.0) GO TO 18
IF(T-GE.500.0) GO TO 17
IF(T-GE.100.0) GO TO 16
N=12
GO TO 33
16 N=13
GO TO 33
17 N=14
GO TO 33
18 IF(P-GE.30.0) GO TO 20
IF(P-GE.5.0) GO TO 19
N=15
GO TO 33
19 N=16
GO TO 33
20 IF(P-GE.500.0) GO TO 22
IF(P-GE.100.0) GO TO 21
N=17
GO TO 33
21 N=18
GO TO 33
22 N=19
GO TO 33
33 FP=(P-BP(N))/DP(N)
IP=FP
IF(IP-CT.MX(N)) IP=MX(N)
F=FP-IP
F=1.0-F
FT=(T-BT(N))/DT(N)

```

```

55.473, .3982, .3965, .3957, .4894, .4749, .4681, .6979, .6255, .5913, .5219,
6.97, .8517, 2.345, 1.696, 1.386, 4.337, 3.001, 2.349, 7.089, 4.935, 3.832, .3
7968, .395, .3946, .4772, .462, .4502, .6369, .5608, .516, 1.01, .7463, .6794
8, 1.805, 1.107, .9283, 3.249, 1.75, 1.36, 5.437, 2.761, 2.041, .3948, .3943, .
9394, 2.4596, .4554, .4543, .5486, .5276, .5219, .7038, .6307, .6111, .9936,
DATAAH/.7976, .7451, 1.504, 1.071, .9552, 3.13, 1.496, 1.273/
DATA JP7, 5.3, 6.4, 3.6, 6.7, 5.5, 9.5, 2.5, 4.3, 3.3/
DATA MX/5, 3.1, 4.2, 1.4, 4.5, 3.3, 7.3, 0.3, 2.1, 1.1/
DATA LOC/1, 78, 123, 168, 204, 236, 251, 281, 329, 392, 417, 442, 487, 512, 524,
1 604, 668, 689, 710/
DATA BP/52, 700, .2500, .0, .100, .142, .5, 187.5, 187.5, 400, .700, .0, .0, .
1 0, .0, .1, .0, .0, .100, .0, /
DATA DP/108, .450, .1250, .20, .30, .22, .5, 42.5, 42.5, 450, .175, .625, .
1 1250, .3000, .1, .10, .40, .300, .1500, /
DATA 8T/26, .28, .30, .25, .52, .56, .56, .59, .56, .60, .80, .100, .180, .500,
1 1, 3000, .13000, .3000, .3000, .3000, /
DATA DT/3, .4, .5, .11, .4, .1, .3, .3, .3, .10, .5, .20, .80, .500, .200, .
1 500, .500, .500, /
DATA PS/1, 022, 2.0, 4.0, 8.0, 14.0, 25.0, 43.0, 69.0, 99.0, 128.0, 151.0,
1165.0, 176.0, 182.0, 185.0, 186.5, 187.25, 187.48875, 187.506/
DATA TS/24, 845, 27.07, 29.81, 33.07, 36.18, 39.96, 44.12, 48.33, 51.97,
154.79, 56.72, 57.80, 58.57, 59.99, 59.18, 59.29, 59.34, 59.353, 59.356/
P=RES
IF(P-LT.1.0) P=1.0
T=TEMP
IF(T-GE.6000.0) T=5999.9999
DIV=1.0
IF(T-GE.100.0) GO TO 15
TZ=24.84+.00317*P
IF(T-LT.TZ) T=TZ
IF(P-GE.700.0) GO TO 4
IF(T-GE.80.0) GO TO 3
IF(P-LT.187.506) GO TO 7
IF(T-LT.56.0) GO TO 12
IF(P-GT.400.0) GO TO 2
TM=(-.0000523467*P+.08698291)*P+.882441
IF(T-GE.TM) GO TO 1
N=7
DIV=(P-187.506)*.083*TM-T
GO TO 33
1 N=8
DIV=(P-187.506)*.083*TM-T
GO TO 33
2 N=9
GO TO 33
3 N=11
GO TO 33
4 IF(P-GE.2500.0) GO TO 6
IF(T-GE.60.0) GO TO 5
N=2
GO TO 33
5 N=10
GO TO 33
6 N=3
GO TO 33
7 DO 8 I=2,19
IF(P-PS(I)) 10,9,8
9 CONTINUE
8 CONTINUE

```



```

IT=FT
FF=FT-IT
FT=1.0-FF
I=IT*JP(N)*IP*LOC(N)
J=I*JP(N)
ETCOND=(FP*FT*C(I)+F*FT*C(I+1)+FP*FF*C(J)+F*FF*C(J+1))/DIV
RETURN
END

SUBROUTINE EATACJND
COMMON/EAMDA/C(730)
DATA(C(I),I=308,396)=.3339,.4294,.563,.693,.824,.3848,.4405,.5207
1.6389,.7636,.9879,.4997,.5553,.6299,.7288,.8536,.9969,.6219,.6783
2.7511,.8433,.9581,.894,.7508,.8084,.8807,.9696,.1078,.1207,.06345
3.0640,.06805,.0672,.06829,.06931,.07028,.06142,.06308,.06456,.065
91,.06715,.06811,.06944,.059,.0609,.06271,.06431,.06575,.06707,.068
53,.05726,.05989,.06074,.06238,.06407,.06559,.06699,.05507,.05724,.
685917,.0609,.06246,.0639,.06548,.05217,.05503,.05732,.05931,.06108
7.06266,.06414,.04902,.05256,.05531,.05758,.05956,.06133,.06293,.0
84689,.05831,.05329,.05582,.05799,.05991,.06164,.04584,.04878,.0516
92,.05419,.05647,.0585,.0603,.06033,.06905,.07716,.08331,.08849,.09306
DATA(C(I),I=397,489)=.06451,.07532,.08251,.08838,.09343,.06046,.0
1724,.08855,.08698,.09241,.05677,.06965,.07764,.08456,.09427,.05479,
2.06618,.07469,.0815,.08736,.03212,.03576,.04274,.05294,.06034,.034
33,.03781,.04321,.05109,.05833,.03616,.03939,.04405,.05024,.05672,.
403773,.04073,.04478,.04944,.05557,.03981,.04183,.04544,.04989,.054
579,.03902,.05246,.06828,.07893,.08736,.09423,.1002,.1055,.1103,.04
624,.0521,.0634,.07366,.08159,.08838,.0943,.09956,.1044,.04416,.051
755,.06038,.06869,.07633,.08278,.08846,.09354,.09819,.04606,.05256,
8.05992,.06724,.07398,.08003,.08547,.09042,.09498,.0479,.05376,.060
916,.06659,.07267,.07829,.08345,.0882,.09261,.0479,.06017,.07267
DATA(C(I),I=490,594)=.08345,.09261,.0595,.06942,.0787,.08735,.09
1526,.07385,.08069,.08691,.09278,.09839,.08811,.09256,.0965,.1003,
210,.1014,.104,.1063,.1084,.1107,.1014,.1071,.1661,.1576,.2217,.20
342,.2777,.2777,.3361,.3354,.4107,.3942,.4107,.4058,.4036,.4023,.40
414,.4607,.4479,.4423,.4389,.4366,.5407,.5113,.4982,.4905,.4851,.67
537,.6121,.5848,.5685,.5574,.8929,.7742,.7215,.69,.6685,.1242,.1029
6,.9339,.0773,.8385,.1772,.1414,.1254,.1158,.1093,.2538,.1973,.1718
7.1565,.1463,.5852,.7462,.3632,.131,.9724,.9353,.7633,.3219,.2866,2
8.656,.529,5.025,.4298,3.847,3.531,8.241,6.483,5.501,5.006,4.598,9
9.796,8.013,6.995,6.318,5.825,10.83,9.406,8.404,7.685,7.14,11.)
DATA(C(I),I=595,702)=10.37,9.586,8.934,8.402,10.22,10.65,10.31,9.
1864,9.4439,.4036,.3992,.3976,.3969,.4423,.4309,.4268,.425,.4983,47
22,.4627,.4585,.505,.5298,.5102,.5016,.7219,.611,.577,.5605,9349
3,.7423,.6739,.6436,.1256,.9293,.8132,.7616,1.723,1.198,1.011,.9272
4.2373,1.571,1.283,1.155,3.239,2.073,1.65,1.46,4.34,2.722,2.128,1.
589,5.665,3.531,2.73,2.363,7.155,4.495,3.463,2.981,8.689,5.591,4.3
624,3.717,10.05,6.75,5.285,4.554,10.99,7.886,6.309,5.473,.3982,.396
75,.3957,.4894,.4749,.4681,.6979,.6255,.5913,1.219,.97,.8817,2.345,
81.696,1.386,4.337,3.001,2.349,7.089,4.935,3.835,.3966,.395,.3946,.
94772,.462,.4582,.6369,.5688,.5416,1.01,7.463,6.794,1.805,1.107
DATA(C(I),I=703,730)=.9283,3.249,1.75,1.36,5.437,2.761,2.041,.394
18,.3943,.3942,.4596,.4554,.4543,.5486,.5276,.5219,.7038,.6307,.611
21,.9936,.7976,.7451,1.504,1.071,.955,2.313,1.496,1.273
END

```

[illegible]

```

N=1
GO TO 30
1 IF (T.GE.3000.0) GO TO 4
  IF (T.GE.2000.0) GO TO 2
  N=2
  GO TO 30
2 IF (P.GT.5.0) GO TO 3
  N=3
  GO TO 30
3 N=4
  GO TO 30
4 IF (T.GE.6000.0) T=5999.9999
  IF (P.GE.5.0) GO TO 5
  N=5
  GO TO 30
5 IF (P.GE.30.0) GO TO 6
  N=6
  GO TO 30
6 N=7
  GO TO 30
7 IF (P.LT.1469.6) GO TO 12
  IF (T.GE. 63.0) GO TO 10
  IF (T.GE.41.4) GO TO 9
  N=8
  T=24.84+0.00317*P
  IF (T.LT.72) T=72
  GO TO 30
9 N=9
  GO TO 30
10 IF (T.GE.117.0) GO TO 11
  N=10
  GO TO 30
11 N=11
  GO TO 30
12 IF (T.GE.59.4) GO TO 17
  N=12
  IF (P.GE.187.6385) GO TO 8
  DO 13 I=2,20
  IF (P-PS(I))15,14,13
  13 CONTINUE
  14 TL=TS(I)
  GO TO 16
15 TL=TS(I-1)+(TS(I)-TS(I-1))*(P-PS(I-1))/(PS(I)-PS(I-1))
  16 IF (T.LE.TL) GO TO 8
  N=13
  GO TO 30
17 IF (T.LT.126.0) GO TO 18
  N=14
  GO TO 30
18 GO TO 30
19 IF (P.LT.587.84) GO TO 19
  N=15
  GO TO 30
19 IF (T.LT.99.0) GO TO 20
  N=16
  GO TO 30
20 IF (P.GE.190.0) GO TO 21
  N=13
  GO TO 30
1 IF (T.GE.3000.0) GO TO 4

```

```

1.946E-11,4.211E-11,5.525E-11,2.962E-11,4.035E-11,5.165E-11,3.034E-
211,3.954E-11,4.874E-11,1.29E-10,1.48E-10,1.677E-10,1.866E-10,2.058
3E-10,2.25E-10,1.033E-10,1.183E-10,1.335E-10,1.493E-10,1.656E-10,1.
4825E-10,8.563E-11,9.818E-11,1.107E-10,1.233E-10,1.363E-10,1.496E-1
50,7.246E-11,8.358E-11,9.433E-11,1.05E-10,1.158E-10,1.267E-10,6.196
6E-11,7.234E-11,8.199E-11,9.135E-11,1.008E-10,1.1E-10,5.305E-11,6.3
724E-11,7.223E-11,8.073E-11,8.902E-11,9.723E-11,4.487E-11,5.552E-11
9.6.423E-11,7.216E-11,7.974E-11,8.717E-11,3.647E-11,4.869E-11,5.747
9E-11,6.505E-11,7.214E-11,7.898E-11,6.15E-12,4.232E-11,5.16E-11/
DATAE/5.906E-11,6.576E-11,7.217E-11,6.56E-12,3.651E-11,4.605E-11,
15.353E-11,6.013E-11,6.587E-11,6.3E-12,7.49E-12,5.8E-12,0.9,3E-12,
2.004E-11,1.209E-11,2.554E-11,1.198E-11,1.249E-11,1.318E-11,1.434E
3.1E-11,1.42E-11,1.483E-11,1.53E-11,1.587E-11,1.667E-11,1.701E-11,1.7
438E-11,1.78E-11,1.877E-11,2.006E-11,2.192E-11,2.457E-11,2.739E-11,
53.019E-11,2.075E-11,2.185E-11,2.325E-11,2.513E-11,2.729E-11,2.946E
6.11,2.263E-11,2.36E-11,2.473E-11,2.617E-11,2.785E-11,2.982E-11,2.4
728E-11,2.532E-11,2.625E-11,2.744E-11,2.88E-11,3.029E-11,3.444E-11,
86.191E-11,6.881E-11,7.543E-11,4.613E-11,5.54E-11,4.921E-11,5.599E-11,6.091E
9.11,3.164E-11,3.980E-11,4.432E-11,2.234E-11,2.867E-11,3.427E-11,3.911E-11
DATAAF/3.919E-11,4.432E-11,2.234E-11,2.867E-11,3.427E-11,3.911E-11
1.2,131E-11,2.623E-11,3.099E-11,3.553E-11,2.113E-11,2.509E-11,2.9E-
211,3.24E-11,2.141E-11,2.463E-11,2.792E-11,3.134E-11,2.192E-11,2.45
37E-11,2.739E-11,3.019E-11,1.557E-11,1.635E-11,1.739E-11,1.901E-11,
4C.131E-11,1.667E-11,1.738E-11,1.826E-11,1.948E-11,2.113E-11,1.774E
5.11,1.839E-11,1.916E-11,2.014E-11,2.141E-11,1.877E-11,1.941E-11,2.
6006E-11,2.099E-11,2.192E-11,2.351E-11,3.651E-11,3.9E-11,4.148E-11,4.397E-11,
74.645E-11,2.868E-11,3.35E-11,3.675E-11,3.938E-11,4.154E-11,2.076E-
811,2.766E-11,3.178E-11,3.483E-11,3.716E-11,1.748E-11,2.262E-11,2.7
922E-11,3.068E-11,3.329E-11,1.649E-11,2.5E-11,2.37E-11,2.712E-11/
DATAAG/3.E-11,1.614E-11,1.857E-11,2.156E-11,2.448E-11,2.72E-11,1.6
112E-11,1.79E-11,2.025E-11,2.27E-11,2.517E-11,1.625E-11,1.766E-11,1
2.95E-11,2.154E-11,2.37E-11,1.649E-11,1.766E-11,1.913E-11,2.086E-11
3.2.268E-11,1.676E-11,1.774E-11,1.896E-11,2.044E-11,2.202E-11,1.707
4E-11,1.79E-11,1.892E-11,2.019E-11,2.157E-11,1.739E-11,1.82E-11,1.9
501E-11,2.016E-11,2.131E-11,2.248E-11,2.381E-11,2.52E-11,2.67E-11,3.086E-11,
63.181E-11,3.261E-11,3.335E-11,3.401E-11,3.461E-11,3.52E-11,3.573E-
711,1.431E-11,1.56E-11,1.812E-11,2.297E-11,2.59E-11,2.757E-11,2.885
8E-11,2.987E-11,3.076E-11,3.154E-11,3.225E-11,1.368E-11,1.429E-11,1
9.511E-11,1.626E-11,1.791E-11,2.015E-11,2.259E-11,2.458E-11/
DATAAH/2.611E-11,2.728E-11,2.831E-11,1.35E-11,1.394E-11,1.438E-11,
11.508E-11,1.578E-11,1.689E-11,1.8E-11,1.949E-11,2.099E-11,2.246E-1
21,2.394E-11,1.35E-11,1.438E-11,1.578E-11,1.8E-11,2.099E-11,2.394E-
311,1.347E-11,1.412E-11,1.503E-11,1.634E-11,1.815E-11,2.032E-11,1.3
453E-11,1.404E-11,1.471E-11,1.562E-11,1.683E-11,1.833E-11,1.363E-11
5.1.405E-11,1.459E-11,1.526E-11,1.615E-11,1.725E-11,1.377E-11,1.414
6E-11,1.458E-11,1.512E-11,1.582E-11,1.664E-11,1.737E-11,1.484E-11,1
7.664E-11,1.393E-11,1.486E-11,1.635E-11,1.409E-11,1.489E-11,1.61E-1
81,1.427E-11,1.499E-11,1.604E-11,1.445E-11,1.509E-11,1.6E-11,1.464E
9.11,1.523E-11,1.604E-11,1.464E-11,1.523E-11,1.604E-11,1.563E-11/
DATAAI/1.606E-11,1.658E-11,1.662E-11,1.697E-11,1.736E-11/
P=PRES
IF (P.LT.1.0) P=1.0
T=TEMP
IF (T.LT.180.0) GO TO 7
IF (T.GE.500.0) GO TO 1
N=1
GO TO 30
1 IF (T.GE.3000.0) GO TO 4

```

```

21 IF(P.LT.293.92) GO TO 22
   N=17
   GO TO 30
22 IF(T.GE.72.0) GO TO 24
   IF(T.GE.64.8) GO TO 23
   N=18
   GO TO 30
23 N=19
   GO TO 30
24 IF(T.GE.81.0) GO TO 25
   N=20
   GO TO 30
25 N=21
30 PD=(P-8P(N))/DP(N)
   IP=FP
   IF(IP.GT.MX(N)) IP=MX(N)
   F=FP-IP
   F=(1-BT(N))/DT(N)
   IT=F*DT
   FT=1.0-F
   I=IT*JP(N) IP+LOC(N)
   J=I+JP(N)
   ETIVISC=FP*FT*V(J)+F*FT*V(I+1)+FP*FF*V(J)+F*FF*V(J+1)
   RETURN
END

SUBROUTINE EDVISC
COMMON/EDVISC0/V(1536)
DATA(V(1),1-196,259)=3.28E-11,4.627E-11,5.023E-11,6.956E-11,3.134
1E-12,4.364E-11,5.450E-11,6.503E-11,3.05E-11,4.65E-11,6.177E-11,2.9
24E-11,4.211E-11,5.525E-11,2.962E-11,4.035E-11,5.165E-11,3.034E-11
3.3.954E-11,4.874E-11,1.29E-10,1.48E-10,1.677E-10,1.866E-10,2.058E-
418,2.25E-10,1.033E-10,1.183E-10,1.335E-10,1.493E-10,1.656E-10,1.82
55E-10,8.563E-11,9.818E-11,1.107E-10,1.233E-10,1.363E-10,1.498E-10,
67.246E-11,8.358E-11,9.433E-11,1.05E-10,1.159E-10,1.267E-10,1.3619E-
711,7.234E-11,8.199E-11,9.135E-11,1.086E-10,1.1E-10,5.305E-11,6.324
8E-11,7.223E-11,8.073E-11,8.902E-11,9.723E-11,4.487E-11,5.552E-11,6
9.23E-11,7.216E-11,7.974E-11,8.717E-11,3.647E-11,4.869E-11)
DATA(V(1),1-269,324)=5.747E-11,6.505E-11,7.214E-11,7.898E-11,6.15
1E-12,4.232E-11,5.16E-11,5.906E-11,6.576E-11,7.217E-11,6.56E-12,3.6
251E-11,4.645E-11,5.353E-11,6.013E-11,6.587E-11,6.3E-12,7.49E-12,5.
38E-12,0.9.3E-12,1.004E-11,1.209E-11,2.554E-11,1.198E-11,1.249E-11
4.1.318E-11,1.436E-11,1.442E-11,1.483E-11,1.53E-11,1.587E-11,1.667E
5-11,1.701E-11,1.738E-11,1.78E-11,1.877E-11,2.086E-11,2.192E-11,2.4
57E-11,2.739E-11,3.019E-11,2.075E-11,2.185E-11,2.325E-11,2.513E-11
7.2.729E-11,2.946E-11,2.263E-11,2.36E-11,2.473E-11,2.617E-11,2.785E
8-11,2.962E-11,2.428E-11,2.532E-11,2.625E-11,2.744E-11,2.88E-11,3.0
929E-11,5.444E-11,6.191E-11,6.001E-11,7.543E-11,4.154E-11)
DATA(V(1),1-325,388)=4.921E-11,5.559E-11,6.091E-11,3.164E-11,3.98
18E-11,4.613E-11,5.159E-11,5.71E-11,3.308E-11,3.919E-11,4.432E-11,
22.234E-11,2.867E-11,3.427E-11,3.911E-11,2.131E-11,2.623E-11,3.099E
3-11,3.553E-11,2.113E-11,2.509E-11,2.9E-11,3.28E-11,2.141E-11,2.463
4E-11,2.792E-11,3.134E-11,2.192E-11,2.457E-11,2.739E-11,3.019E-11,1
5.557E-11,1.635E-11,1.73E-11,1.90E-11,2.131E-11,1.667E-11,1.738E-
611,1.826E-11,1.948E-11,2.113E-11,1.774E-11,1.839E-11,1.916E-11,2.0
714E-11,2.141E-11,1.877E-11,1.941E-11,2.006E-11,2.099E-11,2.192E-11

```

```

8.3.65E-11,3.9E-11,4.140E-11,4.397E-11,4.645E-11,4.606E-11,3.35E-11
91.3.675E-11,3.930E-11,4.154E-11,2.076E-11,2.766E-11,3.178E-11)
DATA(V(I),I=399,453)-3.403E-11,3.716E-11,1.740E-11,2.262E-11,2.72
12E-11,3.068E-11,3.329E-11,1.649E-11,2.512E-11,2.377E-11,2.712E-11,3.E
39E-11,2.025E-11,2.27E-11,2.517E-11,1.625E-11,2.72E-11,1.612E-11,1.7
454E-11,2.37E-11,1.649E-11,1.766E-11,1.913E-11,2.086E-11,2.268E-11
5.1.676E-11,1.774E-11,1.896E-11,2.044E-11,2.202E-11,1.707E-11,1.79E
6-11,1.092E-11,2.019E-11,2.157E-11,1.739E-11,1.82E-11,1.901E-11,2.0
7.16E-11,2.131E-11,2.484E-11,2.818E-11,2.97E-11,3.086E-11,3.181E-11,
83.281E-11,3.333E-11,3.401E-11,3.461E-11,3.52E-11,3.573E-11,1.431E-
911.1.56E-11,1.812E-11,2.297E-11,2.59E-11,2.757E-11,2.885E-11,1.36
DATA(V(I),I=454,517)-2.987E-11,3.076E-11,3.154E-11,3.225E-11,1.36
1.E-11,1.429E-11,1.511E-11,1.626E-11,1.791E-11,2.015E-11,2.259E-11,
22.458E-11,2.611E-11,2.728E-11,2.831E-11,1.35E-11,1.394E-11,1.438E-
311.1.508E-11,1.578E-11,1.609E-11,1.6E-11,1.949E-11,2.099E-11,2.246
4E-11,2.394E-11,1.35E-11,1.438E-11,1.578E-11,1.8E-11,2.099E-11,2.39
54E-11,1.347E-11,1.413E-11,1.503E-11,1.634E-11,1.815E-11,2.032E-11,
61.353E-11,1.404E-11,1.471E-11,1.562E-11,1.683E-11,1.833E-11,1.363E
7-11,1.405E-11,1.459E-11,1.526E-11,1.615E-11,1.725E-11,1.377E-11,1.1.
8414E-11,1.508E-11,1.512E-11,1.562E-11,1.664E-11,1.377E-11,1.484E-1
91.1.684E-11,1.393E-11,1.486E-11,1.635E-11,1.489E-11,1.489E-11)
DATA(V(I),I=518,536)-1.61E-11,1.427E-11,1.499E-11,1.604E-11,1.445
1E-11,1.509E-11,1.6E-11,1.464E-11,1.523E-11,1.604E-11,1.464E-11,1.5
223E-11,1.604E-11,1.563E-11,1.606E-11,1.656E-11,1.662E-11,1.697E-11
3.1.736E-11)
ENC

```

# FUNCTION ETSOUN(PRES,TEMP)

```

COMMON/ESPEED/V(522)
DIMENSION LOC(23),JP(19),MX(19),BP(19),DP(19),BT(23),OT(19),PS(20)
1,TS(20),TL(10),V(522)
DATA(V(I),I=1,193)-5250.,5252.,5266.,5405.,6052.,6929.,6930.,6940
1.,7844.,7937.,8227.,8228.,8236.,8321.,8734.,9298.,9302.,9310.,9384
2.,9745.,10160.,10228.,10240.,10310.,10640.,10700.,10940.,11050.,11
3150.,11450.,11240.,11470.,11700.,11800.,12190.,12140.,12070.,12260
4.,12510.,12460.,2176.,3187.,4569.,2677.,3610.,4709.,3105.,3963.,49
505.,3490.,4284.,5127.,3846.,4567.,5360.,4179.,4873.,5595.,4430.,51
646.,5826.,4784.,5405.,5852.,1975.,1981.,2285.,2976.,3671.,4238.,47
709.,2255.,2320.,2488.,3025.,3606.,4126.,4591.,2510.,2684.,2754.,31
878.,3662.,4123.,4539.,2735.,2849.,2991.,3350.,3754.,4157.,4545.,29
934.,3852.,3187.,3586.,3857.,4217.,4569.,4999.,5196.,5491.,6053.)
DATA(TL=24.846,27.175,29.310,31.299,33.176,34.962,36.672,38.317,
139.904,41.450)
DATA(PS=1.022,2.448,4.814,7.254,9.699,12.051,14.451,16.816,19.182
1.,185.,186.5,187.25,187.46875,187.506,190./
DATA(TS=24.846,27.07,29.81,33.07,36.18,39.96,44.12,48.33,51.97,54.
179.56,72.57,80.58,87.58,99.59,105.29,119.34,124.83,129.59,135.59,141.
DATA(JP=5.5,5.3,7.6,6.1,3.4,4.6,7.4,6.12,7.4)
DATA(BT=0.0,0.0,1.3,2.0,9.1,2.2,4.5,2.4,10.1,0)
DATA(OT=1000.,100.,10.,3000.,1000.,1000.,1000.,1000.,1000.,1000.,
1300.,0.10.,100.,190.,0,1000.)
DATA(DP=4000.,900.,90.,10.,4000.,1000.,500.,100.,200.,200.,
1100.,50.,50.,60.,40.,10.,500.,500./
DATA(BT/800.,800.,800.,800.,240.,120.,20.,20.,20.,20.,25.,50.,63.,
168.,26.,50.,60.,120.,80.,5000.,5000.,5000./
DATA(OT/600.,600.,600.,600.,1500.,80.,30.,20.,20.,10.,10.,5.,2.,4.,5.
1,2.,1.,30.,10./
DATA(LOC/4,3,2,1,4,1,67,102,100,136,191,212,236,264,300,328,364,400
1,65,330,511,510,509,500/
DATA(TOP=4000.,900.,90.,10.,4000.,1000.,500.,100.,200.,200.,

```

```

FUNCTION ETSOUN(PRES,TEMP)
DIMENSION LOC(23),JP(19),MX(19),BP(19),DP(19),BT(23),OT(19),PS(20)
1,TS(20),TL(10),V(522)
DIMENSION AA(105),AB(108),AC(108),AD(111),AE( 90)
EQUIVALENCE ( V,AA), ( V( 106),AB), ( V( 214),AC), ( V( 322),AD)
1 ( V( 433),AE)
DATA TL/24.846,27.175,29.310,31.299,33.176,34.962,36.672,38.317,
139.904,41.450/
DATA PS/1.022,2.448,4.814,7.254,9.699,12.051,14.451,16.816,19.182
1.,185.,186.5,187.25,187.46875,187.506,190./
DATA TS/24.846,27.07,29.81,33.07,36.18,39.96,44.12,48.33,51.97,54.
179.56,72.57,80.58,87.58,99.59,105.29,119.34,124.83,129.59,135.59,141.
DATA JP/5.5,5.3,7.6,6.1,3.4,4.6,7.4,6.12,7.4/
DATA MX/0.0,0.0,1.3,2.0,9.1,2.2,4.5,2.4,10.1,0/
DATA BP/1000.,100.,10.,3000.,1000.,1000.,1000.,1000.,1000.,1000.,
1300.,300.,0.10.,100.,190.,0.,10.,3/
DATA DP/4000.,900.,90.,10.,4000.,1000.,500.,100.,200.,200.,
1100.,50.,50.,60.,40.,10.,500.,500./
DATA BT/800.,800.,800.,800.,240.,120.,20.,20.,20.,20.,25.,50.,63.,
168.,26.,50.,60.,120.,80.,5000.,5000.,5000./
DATA OT/600.,600.,600.,600.,1500.,80.,30.,20.,20.,10.,10.,5.,2.,4.,5.
1,2.,1.,30.,10./
DATA LOC/4,3,2,1,4,1,67,102,100,136,191,212,236,264,300,328,364,400
1,65,330,511,510,509,500/
DATA(AA/5250.,5252.,5266.,5405.,6052.,6929.,6930.,6940.,7044.,7537.

```

```

1100..50..50..60..40..10..500..500..
DATA(8T=800..600..800..600..240..120..20..20..80..25..50..63..
188..250..50..60..25..25..5000..5000..5000..5000..)
DATA(10T=600..600..600..600..80..30..20..20..10..5..5..2..4..5.
1..2..1..30..10.)
DATA(LOC=4,3,2,1,41,67,102,100,136,191,212,236,264,300,328,364,410
1..65,330,511,510,509,508)
P=PRES
IF(P.LT.1.0) P=1.0
T=TEMP
IF(T.LT.120.) GO TO 6
IF(T.LT.800.) GO TO 4
IF(T.GE.6000.) T=5999.99999
IF(P.LT.100.) GO TO 2
IF(P.LT.1000.) GO TO 1
N=1
N1=20
GO TO 33
1 N=2
N1=21
GO TO 33
2 IF(P.LT.10.) GO TO 3
N=3
N1=22
GO TO 33
3 N=4
N1=23
GO TO 33
4 IF(T.LT.240.) GO TO 5
N=5
GO TO 33
5 N=6
IF(P.LT.1000.) N=18
GO TO 33
6 IF(P.LT.1000.) GO TO 8
IF(P.LT.2000.) GO TO 7
N=7
GO TO 30
7 N=8
IF(T.LT.100.) AND.(T.GE.80.) AND.(P.LT.1500.) N=19
GO TO 30
8 IF(T.LT.80.) GO TO 9
N=9
GO TO 33
9 IF(P.LT.600.) GO TO 10
N=10
GO TO 30
10 IF(P.LT.300.) GO TO 12
IF(T.LT.50.) GO TO 11
N=12
IF(P.LT.550.) AND.(T.GE.63.) AND.(T.LE.73.) N=13
GO TO 33
11 N=11
GO TO 30
12 IF(T.LT.68.) GO TO 13
N=14
GO TO 33
13 IF(T.LT.60.) GO TO 15

```

```

1..4227..8228..8236..8321..8734..9298..9302..9310..9384..9745..10160
2..10220..10240..10310..10640..10700..10940..11050..11150..11450..1
31240..11470..11700..11860..12190..12140..12070..12260..12510..1286
40..2176..3107..4569..3610..4709..3105..3963..4905..3490..428
54..5127..3846..4587..3360..4179..4873..5595..4490..5146..5826..479
64..5805..6052..1975..1981..2205..2976..3671..4238..4709..2255..232
70..2488..3025..3606..4126..4591..2510..2634..2754..3178..3682..412
82..4539..2735..2849..2991..3350..3754..4457..4545..2934..3082..318
97..3504..3857..4217..4569..4999..5196..5447..5053..6550..6804../
DATA(8T=800..600..800..600..240..120..20..20..80..25..50..63..
188..250..50..60..25..25..5000..5000..5000..5000..)
DATA(10T=600..600..600..600..80..30..20..20..10..5..5..2..4..5.
1..2..1..30..10.)
DATA(LOC=4,3,2,1,41,67,102,100,136,191,212,236,264,300,328,364,410
1..65,330,511,510,509,508)
P=PRES
IF(P.LT.1.0) P=1.0
T=TEMP
IF(T.LT.120.) GO TO 6
IF(T.LT.800.) GO TO 4
IF(T.GE.6000.) T=5999.99999
IF(P.LT.100.) GO TO 2
IF(P.LT.1000.) GO TO 1
N=1
N1=20
GO TO 33
1 N=2
N1=21
GO TO 33
2 IF(P.LT.10.) GO TO 3
N=3
N1=22
GO TO 33
3 N=4
N1=23
GO TO 33
4 IF(T.LT.240.) GO TO 5
N=5
GO TO 33
5 N=6
IF(P.LT.1000.) N=18
GO TO 33
6 IF(P.LT.1000.) GO TO 8
IF(P.LT.2000.) GO TO 7
N=7
GO TO 30
7 N=8
IF(T.LT.100.) AND.(T.GE.80.) AND.(P.LT.1500.) N=19
GO TO 30
8 IF(T.LT.80.) GO TO 9
N=9
GO TO 33
9 IF(P.LT.600.) GO TO 10
N=10
GO TO 30
10 IF(P.LT.300.) GO TO 12
IF(T.LT.50.) GO TO 11
N=12
IF(P.LT.550.) AND.(T.GE.63.) AND.(T.LE.73.) N=13
GO TO 33
11 N=11
GO TO 30
12 IF(T.LT.68.) GO TO 13
N=14
GO TO 33
13 IF(T.LT.60.) GO TO 15

```

```

IF(P.LT.190.) GO TO 14
N=17
GO TO 33
N=15
GO TO 33
N=15
DO 16 I=2,20
IF(P.LT.PS(I)) GO TO 17
16 CONTINUE
GO TO 18
17 TM=TS(I-1)+(TS(I)-TS(I-1))*(P-PS(I-1))/(PS(I)-PS(I-1))
IF(T.GT.TM) GO TO 33
18 IF(T.LT.50.) GO TO 19
N=16
GO TO 33
N=11
GO TO 30
19 N=11
GO TO 30
30 F=P/507.84
I=F
IF(I.GT.8) I=8
F=F-I
TQ=(1.-F)*T(I+1)+F*T(I+2)
IF(T.LT.TQ) T=TQ
33 FP=(P-8P(N))/OP(N)
IP=FP
IF(IP.GT.MX(N)) IP=MX(N)
F=FP-IP
FP=1.0-F
FT=(1.-8T(N1))/DT(N)
.T=FT
FF=FT-IT
FT=1.0-FF
I=IT*JP(N)+TP*LOC(N1)
J=I*JP(N)
ETSOUN=FP*FT*V(I)+F*FT*V(I+1)+FP*FF*V(J)+F*FF*V(J+1)
RETURN
END

SUBROUTINE ESOUND
COMMON/ESPED/V(522)
DATA((V(I),I=104,209)=6550.,6804.,4294.,4632.,4919.,5397.,5800.,50
189.,3276.,3774.,4155.,4749.,5220.,5616.,2395.,3034.,3506.,4208.,47
235.,5165.,2104.,2646.,3116.,3655.,4422.,4867.,2205.,2580.,2976.,36
371.,4238.,4709.,1592.,1517.,1448.,1399.,1402.,1497.,1672.,1869.,20
459.,2234.,2395.,1585.,1634.,1590.,1562.,1553.,1562.,1654.,1763.,18
594.,2033.,2173.,1781.,1747.,1719.,1703.,1702.,1717.,1757.,1820.,19
602.,1999.,2104.,1878.,1856.,1840.,1834.,1838.,1853.,1882.,1926.,19
784.,2053.,2132.,1975.,1962.,1955.,1955.,1964.,1981.,2007.,2043.,20
889.,2143.,2205.,4570.,4694.,4809.,4280.,4355.,4495.,4591.,3888.,40
963.,3047.,3317.,3542.,2358.,2731.,3019.,1804.,2234.,2570.,1635.,)
DATA((V(I),I=210,315)=1947.,2262.,4178.,4318.,4455.,4560.,3865.,40
180.,4251.,4397.,3590.,3823.,4025.,4200.,3255.,3536.,3766.,3965.,20
281.,3176.,3460.,3691.,2186.,2722.,3100.,3381.,2930.,3100.,3248.,33
301.,2465.,2698.,2886.,3047.,1915.,2256.,2502.,2701.,2294.,1791.,21
414.,2358.,1214.,1426.,1768.,2045.,1309.,1351.,1553.,1804.,1399.,14
502.,1497.,1672.,1530.,1784.,1975.,2132.,2267.,2386.,1294.,1573.,17
691.,1966.,2114.,2243.,1169.,1395.,1619.,1807.,1966.,2104.,1198.,12

```

```

FUNCTION ETCI(PRES,TEMP)
  ETCV=ETHEAT(PRES,TEMP,1)
  RETURN
END
FUNCTION ETCV(PRES,TEMP)
  ETCV=ETHEAT(PRES,TEMP,2)
  RETURN
END
FUNCTION ETGAMM(PRES,TEMP)
  ETGAMM=ETHEAT(PRES,TEMP,3)
  RETURN
END
FUNCTION ETHEAT(PRES,TEMP,KTRANS)
  COMMON/TEHEAT/CP(823),CV(823)
  DIMENSION LOC(23),JP(19),MX(19),
    & TS(12),TL(10)
  DATA PS/.022,2.,.4,8.,14.,25.,43.,69.,99.,126.,151.,160./
  DATA TS/2.,24.5,27.07,29.81,33.07,36.18,39.96,44.12,48.33,51.57,
    & 54.79,56.72,57.46/
  DATA LOC/1,50,71,113,133,141,170,165,228,264,348,372,426,492,528,
    & 584,626,638,734,654,682,694,718/
  DATA JP/1,3,4,5,12,4,19,9,4,7,4,9,6,16,7,7,2,2,5/
  DATA MX/5,14,3,0,2,2,2,5,2,2,7,4,4,5,15,0,0,3/
  DATA BP/.20,0.0,100.0,100.0,100.0,100.0,100.0,100.0,100.0,100.0,
    & 100.0,100.0,40.0,40.0,0.0,0.0,1./
  DATA BT/2600.,2600.,2600.,2600.,800.,300.,120.,25.2,27.,72.,
    & 131.,25.,56.,126.,41.,25.,25.,2600.,15000.,5000.,5000.,15000./
  DATA DP/.5,40.,200.,1000.,4900.,2000.,1175.68,293.92,1175.68,

```

```

FUNCTION ETCI(PRES,TEMP)
  ETCV=ETHEAT(PRES,TEMP,1)
  RETURN
END
FUNCTION ETCV(PRES,TEMP)
  ETCV=ETHEAT(PRES,TEMP,2)
  RETURN
END
FUNCTION ETGAMM(PRES,TEMP)
  ETGAMM=ETHEAT(PRES,TEMP,3)
  RETURN
END
FUNCTION ETHEAT(PRES,TEMP,KTRANS)
  COMMON/TEHEAT/CP(823),CV(823)
  DIMENSION LOC(23),JP(19),MX(19),
    & TS(12),TL(10)
  DATA PS/.022,2.,.4,8.,14.,25.,43.,69.,99.,126.,151.,160./
  DATA TS/2.,24.5,27.07,29.81,33.07,36.18,39.96,44.12,48.33,51.57,
    & 54.79,56.72,57.46/
  DATA LOC/1,50,71,113,133,141,170,165,228,264,348,372,426,492,528,
    & 584,626,638,734,654,682,694,718/
  DATA JP/1,3,4,5,12,4,19,9,4,7,4,9,6,16,7,7,2,2,5/
  DATA MX/5,14,3,0,2,2,2,5,2,2,7,4,4,5,15,0,0,3/
  DATA BP/.20,0.0,100.0,100.0,100.0,100.0,100.0,100.0,100.0,100.0,
    & 100.0,100.0,40.0,40.0,0.0,0.0,0.0,1./
  DATA BT/2600.,2600.,2600.,2600.,800.,300.,120.,25.2,27.,72.,
    & 131.,25.,56.,26.,41.,25.,25.,2600.,15000.,5000.,5000.,15000./
  DATA DP/.5,40.,200.,1000.,4900.,2000.,1175.68,293.92,1175.68,

```



```

4,4 598,5.098,4.806,4.581,4.435,1.556,1.528,1.504,1.481,1.461,1.441,
51,427,2.122,2.079,2.041,2.009,1.981,1.954,1.931,2.94,2.856,2.787,2
6,731,2.683,2.642,2.603,2.564,2.526,2.489,2.453,2.418,2.384,2.351,
73,5.094,4.826,4.641,4.506,4.399,4.314,7.219,6.288,5.799,5.492,5.27
89,5.12,4.998,7.785,7.073,6.501,6.111,5.836,5.632,5.476,6.875,6.913
9,6.657,6.359,6.104,5.899,5.734,6.066,6.296,6.317,6.212,6.06,5.906)
DATA(PS=1.022,2.4,0.14,25.43,69.99,128.151,160.)
DATA(TS=24.845,27.07,29.81,33.07,36.18,39.96,44.12,48.33,51.97,
154.79,156.72,157.46)
DATA(LOC=1.50,71.113,133,141,170,165,228,264,348,372,426,492,528,
1584,626,638,734,654,682,694,718)
DATA(JP=7,3,6,5,2,4,9,9,4,7,4,9,6,6,7,7,2,2,5)
DATA(MX=5,1,3,10,2,2,4,2,5,2,7,4,4,5,5,0,0,3)
DATA(OP=0,20,0,1000,100,1000,1469,6,0,1469,6,587,84,587,84,0,
1100,100,40,40,0,0,1)
DATA(IT=2600,2600,2600,2600,300,120,120,25,2,27,72,
181,25,56,26,41,25,25,2600,5000,5000,5000,5000)
DATA(OP=5,40,200,1000,1000,14900,2000,1175,68,293,92,1175,68,
1146,96,146,96,73,48,100,100,20,20,40,40,1)
DATA(OT=800,400,400,800,800,600,100,30,30,12,6,9,3,6,9,15,
15,4,8,4,8,8,200)
DATA(TL=24.846,27.175,29.310,31.299,33.176,34.962,36.672,38.317,
139.904,41.456)
KTR=1
GO TO 1
ENTRY FICV
KTR=2
GO TO 1
ENTRY ETGAMM
KTR=3
1 P=PRES
IF(P.LT.1.0) P=1.0
T=TEMP
IF(T.LT.126.) GO TO 9
IF(T.LT.2600.) GO TO 5
IF(T.GE.6000.) T=5999.99999
IF(P.GE.100.) GO TO 3
IF(P.GE.30.) GO TO 2
IF(P.GE.5.) GO TO 20
N=19
GO TO 33
20 N=1
N=20
GO TO 33
2 N=2
N=21
GO TO 33
3 IF(P.GE.1000.) GO TO 4
N=3
N=22
GO TO 33
4 N=4
N=23
GO TO 33
5 IF(T.LT.300.) GO TO 7
IF(T.LT.800.) GO TO 6
N=5
GO TO 33
6 N=6
GO TO 33
7 IF(P.LT.1469.6) GO TO 8
N=7
GO TO 33
8 N=8
GO TO 33
9 IF(P.LT.587.84) GO TO 12
IF(P.LT.1469.6) GO TO 10
N=9
GO TO 30
10 IF(P.LT.1028.72.AND.T.GE.72.0.AND.T.LT.90.0) GO TO 11
N=10
GO TO 30
11 N=11
GO TO 33
12 IF(T.LT.81.) GO TO 13
N=12
GO TO 33
13 IF(P.LT.160.) GO TO 15
TM=((-.86867647E-7*P-.12613701E-3)*P+.10353383)*P+.43.8056678
IF(T.LT.1M) GO TO 14
N=13

```

```

GO TO 33
6 N=6
GO TO 33
7 IF(P.LT.1469.6) GO TO 8
N=7
GO TO 33
8 N=8
GO TO 33
9 IF(P.LT.587.84) GO TO 12
IF(P.LT.1469.6) GO TO 18
N=9
GO TO 30
10 IF(P.LT.1020.72.ANJ.T.GE.72.0.AND.T.LT.90.0) GO TO 11
N=10
GO TO 30
11 N=11
GO TO 33
12 IF(T.LT.81.) GO TO 13
N=12
GO TO 33
13 IF(P.LT.160.) GO TO 15
TM=(1.86867647E-7*P-.12613701E-3)*P+.10353383)*P+43.8056878
IF(T.GT.TM) GO TO 14
N=13
GO TO 30
14 N=14
GO TO 33
15 DO 16 I=2,12
IF(P-PS(I)) 17,17,16
16 CONTINUE
I=12
17 TM=TS(I-1)+(TS(I)-TS(I-1))*(P-PS(I-1))/(PS(I)-PS(I-1))
IF(T.GE.TM) GO TO 18
N=15
IF(P.LT.40.) N=17
GO TO 30
18 N=16
IF(P.LT.40.) N=18
GO TO 33
30 F=P/587.84
IF
IF(I.GT.8) I=8
F=F-I
TQ=(1.0-F)*TL(I+1)+F*TL(I+2)
IF(T.LT.TQ) T=TQ
33 IF(T.LE.5000.0)N1=N
FP=(P-8P(N))/DP(N)
IP=FP
IF(IP.GT.MX(N)) IP=MX(N)
F=FP-IP
FP=1.0-F
FI=(1-8T(N1))/DT(N)
IT=FI
FF=FI-IT
FT=1.0-FF
I=IT*JP(N)+IP+LOC(N1)
J=I+JP(N)
IF(KTR.EQ.2) GOTO 37
CTCP=FP*FT*CP(I)+F*FT*CP(I+1)+FP*FF*CP(J)+F*FF*CP(J+1)
IF(N.LT.13.OR.H.GE.17) GO TO 36
IF(N.LT.15) GO TO 35
CTCP=CTCP/(187.506-P+ABS(1-TM)*28.13)
GO TO 36
35 CTCP=CTCP/(ABS(1-TM)/1.8+ABS(P-187.506)*.008008982)
36 IF(KTR.GE.2) GO TO 37
ETCP=CTCP
ETHEAT=ETCP
RETURN
37 ETCP=FP*FT*CV(I)+F*FT*CV(I+1)+FP*FF*CV(J)+F*FF*CV(J+1)
ETHEAT=ETCP
IF(KTR.LT.3) RETURN
ETCP=CTCP/ETCP
ETHEAT=ETCP
RETURN
END

BLOCK DATA
COMMON/TEHAT/AA(111),AB(111),AC(110),AD(110),AE(110),AF(111),
1AG(111),AH(49),
2 AI(111),AJ(111),AK(110),AL(110),AM(112),AN(109),AO(111)
3 ,AP(49)
DATA/3.804,3.796,3.794,3.794,3.793,3.793,3.793,3.793,3.959,3.945

```

```

CTCP=FPFT*CP(I)+F*FT*CP(I+1)+FP*FF*CP(I)+F*FF*CP(I+1)
IF (N.LT.13.OR.N.GE.17) GO TO 36
IF (N.LT.15) GO TO 35
CTCP=CTCP/(187.506-P+ABSF(T-TM)*28.13)
GO TO 36
35 CTCP=CTCP/(ABSF(T-TM)/1.8+ABSF(P-187.506)*.008008982)
ETCP=CTCP
36 IF (KTR.GE.2) GO TO 37
RETURN
37 ETCP=CP*FT*CV(I)+F*FT*CV(I+1)+FP*FF*CV(I)+F*FF*CV(I+1)
IF (KTR.LT.3) RETURN
ETCP=CTCP/ETCP
END
SUBROUTINE EQCPDT
COMMON/EQHEAT/CP(823),CV(823)
DATA (CP(I),I=326,432)=5.767,5.492,5.713,5.826,5.84,5.792,5.711,5.
162,5.856,5.243,5.37,5.432,5.419,5.375,4.709,4.847,4.985,5.04
23,5.101,5.15,0.98,7.219,6.288,5.799,5.492,7.72,6.695,6.129,5.762,7
3.856,6.991,6.399,6.002,7.649,7.117,6.583,6.173,7.256,7.08,6.669,6
4.277,6.875,6.913,6.657,6.359,6.462,4.722,5.069,5.563,6.184,6.957,6
551,7.938,7.785,4.502,6.698,4.936,5.225,5.569,5.936,6.324,6.657,6.8
675,4.429,4.582,4.759,4.959,5.181,5.422,5.651,5.875,6.066,6.292,4.4
716,4.552,4.699,4.857,5.021,5.187,5.347,5.492,4.133,4.234,4.334,4.4
858,4.577,4.699,4.857,5.021,5.187,5.347,5.492,4.133,4.234,4.334,4.4
928,4.522,4.615,4.709,5.28,3.0,1.35,7.40,35,4.4,48,8.57,29.85)
DATA (CV(I),I=433,540)=30.59,37.28,42.84,47.85,52.88,57.29,80
1.7,45.24,51.13,56.99,22.08,30.36,39.86,47.67,54.65,61.6,68.33,28.4
23.9,87.49,15.57,36.65,51.11,9.24,47.38,44.1,49.36,50.9,68.46,3.261,
318.0,4.4,5.7,5.9,5.6,4.7,30.9,10.86,30.25,44.7,57.36,69.8,1
4.34,12.57,19.88,37.96,51.83,65.61,17.63,45.34,9.839,20.76,40.97,
57.25,2.39,15.73,2.166,11.61,21.83,43.07,10.41,-4.319,8.267,0.10
6.68,24.21,22.39,11.76,9.006,-4.132,12.7,18.04,36.35,24.05,14.97,5
705,-8.046,16.89,50.01,36.78,34.35,19.82,11.46,3.68,63.8,49.89,45.9
841,01,26.82,18.84,77.36,63.02,58.12,54.57,46.69,32.95,1033,1154
9.1265,1310,1370,1415,1453,977,1116,1221,1305,1365,1409,1
DATA (CP(I),I=541,647)=1.460,901.3,1064,1185,1282,1350,1365,1409,1
159,780,8.973,8.117,1231,1311,1379,1437,591,2.823,8.995,3.1
2130,1234,1308,1373,436,3.583,7.794,5.958,7.1071,1166,1246,3
333,1.403,512,3700,6184,7.955,1.1052,408.9,300,363,2347,6.495
4.2,64.7,67.5,329,3.60,00,-66.07,317.8,361.8,313.2,325.1,1116,801.5,520.9,226.7,-17.9,-1
51.5,520.9,226.7,-17.9,-102,2.2076,1727.1430,1159,927.7,697.4,400,3197.2,279.5,462
6.7,400,3197.2,279.5,462,2.2076,1727.1430,1159,927.7,697.4,400,3197.2,279.5,462
70,3255,2983,2725,2471,5535,5078,4696,4359,4075,3806,354
87,157,1.561,1.802,1.792,2.12,2.098,2.525,2.481,3.159,2.997,1.521
9.3,64,2.468,5.29,2.517,3.306,2.701,3.704,3.045,3.636,3.571,3.923
DATA (CP(I),I=648,756)=4.4,237.4,297.4,47.4,462.4,604,35.35,16.84
1.13,19,11.56,59.9,927.9,437.5,41.26,45.20,19.17,34.5,62.14,45
2.13,58,64,36,38,41,29,6,25,3,22,65,20,8,19,42,56,3,4,65,39,92,34
348,30,93,28,4,26,45,9,93,7,931,7,111,15,62,10,89,9,41,7,22,65,15,1
4,12,72,30,93,20,31,16,6,7,938,6,28,4,7,5,461,5,287,5,181,10,9,7
5.93,6,883,6,47,8,14,5,95,15,1,10,3,8,57,7,813,7,857,7,045,17,4
62,13,26,10,7,9,559,8,879,8,413,5,181,4,92,4,804,4,734,4,687,7,045
76,271,5,928,5,724,5,584,8,786,8,248,7,565,7,157,4,881,0,3,802,3,7
899,3,797,3,797,3,796,3,889,3,878,3,873,3,873,3,868,4,018,3,987,3,97
93,3,964,3,559,4,229,4,153,4,119,4,098,4,085,4,592,4,424,4,349)
END

```

```

SUBROUTINE EQCVDT
COMMON/EQGEAT/CP(1623),CV(823)
DATA (CP(I),I=57,823)=.6305,4.275,5.209,4.873,4.725,4.636,4.576,6.
-222,5.602,5.328,5.164,5.052,7.805,6.733,6.268,5.976,5.781,10.7,8
-016,7.639,7.175,6.959,13.55,10.82,9.606,8.803,8.39,18.16,4.4,11.2
-31,11.23,10.49,24.19,18.45,15.67,14.33,3.27,3.65,23.59,4.0,42.12
-29,16.83,40.39,20.5,25.96,23.16,23.21,23.48,9.7,93.32,38.89,26.4
-5,55.96,45.9,39.39,27.35,23.32,33.59,17.51,54.45,75.43,57.38,44.26,4
-7,54.84,50.67,47.03,44.03
DATA (CV(I),I=1,108)=.8019,2.809,2.809,2.809,2.809,2.808,2.808,3.0
-42,97.1,2.959,2.952,2.948,2.946,2.944,3.64,3.271,3.202,3.171,3.152
-14,3.13,3.533,3.923,3.737,3.624,3.557,3.511,3.477,9.353,5.83,4.4
-918,4.602,4.614,4.285,5.19,17.7,8.839,7.219,16.497,16.085,5.77,15.55
-2,29.46,4.23,11.2,12.19,13.8,8.292,7.863,2.816,2.807,2.807,3.946
-2,949,2.936,3.14,3.102,3.086,3.512,3.373,3.316,2.808,2.808,3.739,
-5,778,4.081,4.534,8.308,6.541,5.817,2.807,2.807,2.806,2.806,2.806,
-2,806,2.939,2.933,2.931,2.93,2.929,2.928,3.101,3.071,3.06,3.05,3
-052,3.05,3.373,3.259,3.219,3.201,3.19,3.209,3.899,3.579,3.466,3.41
-5,3.305,3.355,4.883,4.145,3.883,3.767,3.698,3.736,3.649,3.5085
DATA (CV(I),I=109,160)=4.965,5.335,4.197,4.103,2.806,2.806,2.805,2
-804,2.803,3.053,3.945,3.042,3.043,3.038,3.365,3.314,3.231,3.277,3.2
-74,4.103,3.693,7.665,3.702,3.66,2.476,2.5,2.518,2.519,2.639,2.637,
-2,807,2.803,2.48,2.26,3.42,2.398,2.277,2.351,2.409,2.449,2.388,2
-436,2.473,2.499,2.437,2.469,2.502,2.509,2.459,2.481,2.497,2.507,2
-471,2.48,2.491,2.5,3.08,3.12,3.143,3.16,3.172,3.184,3.236,3.278,
-3,316,2.626,2.643,3.661,2.679,2.697,2.711,2.755,2.796,2.834,2.351,2
-351,2.352,2.354,3.36,2.372,2.382,2.439,2.473,2.214,2.222,2.233,2
-231,2.252,2.261,2.298,2.334,2.362,2.162,2.179,2.194,2.206,2.223,2
-236,2.285,3.23,2.354,2.168,2.2,186,2.20,2.219,2.234,2.248,2.299)
DATA (CV(I),I=121,323)=2.330,2.369,2.204,2.22,2.237,2.253,2.267,2
-377,2.37,2.365,2.398,1.117,1.087,1.064,1.054,1.052,1.507,1.497,1
-21,2.189,2.185,2.182,3.019,3.034,3.044,3.046,3.495,3.53,3.5
-357,3.547,3.642,3.607,3.721,3.749,3.548,3.586,3.635,3.681,3.78,3.1
-34,3.454,3.088,3.139,3.181,3.219,1.186,1.184,1.181,1.178,1.1
-3,1.169,1.162,1.164,1.161,4.591,4.57,1.453,1.451,1.448,1.886,1.08
-1,1.884,1.883,1.882,1.88,1.879,2.432,2.43,2.436,2.438,2.444,2.441,
-442,2.994,2.995,2.999,3.004,3.007,3.012,3.015,3.385,3.373,3.373,
-1,3.37,3.383,3.389,3.393,3.602,3.583,3.516,3.576,3.581,3.866,3.592,
-1.63,3.63,3.628,3.628,3.63,3.635,3.641,3.542,3.549,3.553,3.558)
DATA (CV(I),I=324,430)=3.561,3.567,3.572,3.389,3.397,3.403,3.41,3
-422,3.428,3.216,3.224,3.231,3.238,3.244,3.251,3.258,3.446,3
-3,3.462,3.469,3.475,3.075,3.082,3.088,3.385,3.373,3.373,3.397,3.3
-378,3.374,3.79,3.777,3.586,3.55,3.551,3.62,3.606,3.599,3.599,3.63
-3,3.63,3.624,3.62,3.63,3.633,3.628,3.628,3.477,3.503,3.526,3.549,3
-569,3.596,3.613,3.613,3.602,3.515,3.536,3.503,3.572,3.599,3.603,3
-616,3.626,3.63,3.642,3.458,3.474,3.485,3.503,3.517,3.528,3.536,3
-42,3.306,3.319,3.331,3.342,3.354,3.365,3.376,3.384,3.389,3.146,3
-57,3.366,3.176,3.185,3.193,3.203,3.211,3.216,2.987,2.989,3.002,3
-1,3.017,3.024,3.032,3.039,3.046,1.135,1.136,1.137,1.137,1.137)
NO

```

[illegible]

```

FUNCTION ETLFAC(PRES,TEMP)
DIMENSION PS(19),TS(19),JP(19),MX(19),LOC(19),BP(19),DP(19),BT(19)
1017(19),C(730)
DIMENSION AA(109),AB(113),AC(105),AD(108),AE(108),AF( 93),AG( 94),
EQUIVALENCE (CAAA),( C( 104) )ABI,( C( 223) ,ACT),( C( 326) ,AD)
1      ,( C( 436) ,AE),( C( 544) ,AF),( C( 637) ,AG)
DATA JP17,5,3,6,3,4,3,6,6,5,9,5,2,5,4,3,1,3/
DATA MX15,3,1,2,1,4,4,5,3,7,3,0,3,2,1,1,1/
DATA LOC1,178,123,168,206,236,251,281,329,392,447,442,487,512,524,
1604,668,689,710/
DATA BP152,700,0,0,0,0,0,0,142,5,187,5,187,5,400,0,700,0,0,0,
10,0,0,1,0,0,0,0,-100,0/
DATA DP108,450,0,1250,20,30,22,5,42,5,42,5,50,450,175,625,,
11250,3000,,1,10,40,300,1500,/
DATA BT126,28,30,25,32,56,5,59,56,60,80,100,180,500,
13000,3000,3000,3000,3000,/
DATA DT173,4,5,11,4,1,3,3,3,10,5,20,80,500,200,200,,
500,500,500,/

```

```

FUNCTION ETLFAC(PRES,TEMP)
COMMON/ETLFAC JC(1730)
DIMENSION PS(11),TS(11),JP(19),MX(19),LOC(19),8P(19),10P(19),8T(19),
1,10T(19)
DATA(JP=7,5,3,6,4,3,6,6,7,5,5,9,5,2,5,4,3,3,3)
DATA(MX=5,3,1,4,2,1,4,4,5,3,3,7,3,0,3,2,1,1,1)
DATA(LOC=1,7,6,123,168,120,236,251,281,329,392,417,442,487,512,524,
1,60,669,669,710)
DATA(8P=52,700,2500,0,100,142,5,187,5,187,5,400,700,0,0,0,0,
1,0,0,1,0,0,100,0,0)
DATA(10P=108,450,1250,20,30,22,5,42,5,42,5,50,450,175,625,
1,1250,3000,1,10,40,300,1500,0)
DATA(8T=26,28,30,25,52,56,56,59,56,60,80,100,180,502,
1,3000,3000,3000,3000,3000,0)
DATA(10T=3,4,5,11,4,4,3,3,3,10,5,20,80,500,200,200,
1,500,500,500,0)
DATA(1P=1,022,2,0,4,8,0,14,0,25,0,43,0,69,0,99,0,158,0,151,0,
1,65,8,176,0,182,0,185,0,186,5,187,25,187,46675,187,500)

```

```

DATA TS=24.845,27.07,29.81,33.07,36.18,39.96,44.12,48.33,51.97,
154.79,56.72,57.80,58.57,58.99,59.18,59.29,59.34,59.35,59.356,
DATA(TS)=154.79,56.72,57.80,58.57,58.99,59.18,59.29,59.34,59.35,59.356,
110.4,1981.1,1946.4,1911.7,1878.8,1847.1,1816.7,1786.7,1757.1,1728.6,
27.2228,5.2193,9.2160,5.2129,2.2665,5.2613,6.2567,3.2525,2.2466,5.124
350.7,2417.3,3021.2,2956.7,2901.6,2853.4,2801.0,2770.4,2733.5,3339.4,
4380.9,3241.6,3184.5,3134.5,3089.9,3049.3,3786.2,3673.1,3587.1,351
57.2,3458.3,3406.9,3361.2,3317.0,3272.9,3228.6,3184.3,3140.0,3095.7,
671.7,4581.0,4499.9,4322.8,4204.6,4115.7,4044.2,3983.7,3931.5,3879.3,
7474.5,4573.2,4456.5,4368.1,4297.7,4234.6,4171.3,4108.0,4044.7,3980.5,
8460.7,8460.1,5170.3,1160.0,1499.1,1436.0,1219.2,2011.5,1910.3,161
96.11774,2520.4,2395.2,2292.3,2203.6,2125.3,2044.7,2006.8,2696.9,
DATA(TS)=154.79,56.72,57.80,58.57,58.99,59.18,59.29,59.34,59.35,59.356,
10.6,3775.6,3602.3,3475.2,3372.9,3286.9,3192.5,3099.3,3006.1,2913.2,2820.4,
2.3657,3.3601,5.3671,1.4217,4.1024,4.008,3.6964,4.711,5.4550,2.442
38.5,4330.2,1536.1,1364.0,1206.8,1055.1,790.2,524.9,2352.2,2229.3,30
40.9,2027.7,2708.6,3473.1,3288.5,3170.5,3024.1,1373.0,1360.3,9.4330,2
5.4126,4.3995,4.698,7.4486,3.4384,4.5021,6.4799,4.654,5.5295,2.506
63.8,4911.1,5211.7,5280.4,5121.1,5073.5,5434.4,5287.4,5040.0,3587.5,54
715.5,5936.9,5683.3,5508.1,5397.5,5747.1,5557.1,5326.0,5181.0,500.0,
8.0,2661.1,2994.4,3521.1,6105.0,0.0,3211.1,3382.5,3649.9,3955.4,4404.4,
9557.3,4012.4,106.4,4223.2,4371.4,4539.4,4810.4,4726.4,4798.7,4861.3,
DATA(TS)=154.79,56.72,57.80,58.57,58.99,59.18,59.29,59.34,59.35,59.356,
15407.3,15407.3,15407.3,15407.3,15407.3,15407.3,15407.3,15407.3,15407.3,15407.3,
250.7,3150.0,435.5,9517.3,7549.8,5036.2,2684.6,11326.6,9439.5,7151.4
3.4661,3.1420,3.1176,0.1,9398.9,7109.6,1674.0,9.1163,6.1137,4.9424
4.2,1924.4,3.1659,9.0,11565.9,988.6,0.0,1942.4,408.4,0.0,1281.9,738.2,2014.4,5223.8233,11
51679.8,1607.1,1565.9,988.6,0.0,1942.4,408.4,0.0,1281.9,738.2,2014.4,5223.8233,11
62.7,8233.3,1103.2,13693.8,16203.8,835.4,448.8,7570.7,10497.1,13292
7.3,15940.6,1256.0,5510.9,7439.3,10230.1,12992.7,15633.2,1050.0,1990
8.7821.1,10285.2,12662.5,15472.5,0.0,3103.9,6987.1,12247.3,15150.0,
9.2367.9,455.0,3029.9,10913.1,13758.1,1887.5,3909.7,9088.0,8750.7)
P=PRES
IF(P,LT,1.0) P=1.0
T=TEMP
IF(T,GE,6000.0) T=5999.9999
DIV=1.0
IF(T,GE,100.0) GO TO 15
T2=24.84+0.00317*P
IF(T,LT,T2)=T2
IF(P,GE,700.0) GO TO 4
IF(T,GE,80.0) GO TO 3
IF(P,LT,187.506) GO TO 7
IF(T,LT,56.0) GO TO 12
IF(P,GT,400.0) GO TO 2
TH=1-0.0000523467*P+0.00698291*P+44.882441
IF(T,GE,TH) GO TO 1
DIV=(1-187.506)*0.00317*P+44.882441
GO TO 33
1
GO TO 33
2
GO TO 33
3
GO TO 33
4
IF(P,GE,2500.3) GO TO 6

```

```

IF (T-GE.60.0) GO TO 5
N=2
GO TO 33
5 N=10
GO TO 33
6 N=3
GO TO 33
7 DO 8 I=2,19
IF (P-PS(I)) 10,9,8
8 CONTINUE
9 TM=TS(I)
GO TO 11
10 TM=TS(I-1)+(TS(I)-TS(I-1))*(P-PS(I-1))/(PS(I)-PS(I-1))
11 IF (T-GE.TM) GO TO 13
IF (T-LT.56.0) GO TO 12
N=6
DIV=((187.506-P)*.083+TM-7)/10.
GO TO 33
12 N=1
GO TO 33
13 IF (P-GE.100.0) GO TO 14
N=4
GO TO 33
14 N=5
DIV=((187.506-P)*.083+TM-7)/10.
GO TO 33
15 IF (T-GE.300.0) GO TO 18
IF (T-GE.500.0) GO TO 17
IF (T-GE.180.0) GO TO 16
N=12
GO TO 33
16 N=13
GO TO 33
17 N=14
GO TO 33
18 IF (P-GE.30.0) GO TO 20
IF (P-GE.5.0) GO TO 19
N=15
GO TO 33
19 N=16
GO TO 33
20 IF (P-GE.500.0) GO TO 22
IF (P-GE.100.0) GO TO 21
N=17
GO TO 33
21 N=18
GO TO 33
22 N=19
33 PP=(P-PP(N))/DP(N)
IP=PP
IF (IP-GT.MX(N)) IP=MX(N)
P=PP-IP
PP=1.0-F
TT=1-BT(N)/DT(N)
IT=FT
FF=FT-IT
FT=1.0-FF
I=IT*JP(N)+IP+LOC(N)

```

```

40.,71380.,64130.,58910.,1.268E5,1.01E5,88280.,79430.,73090.,1.441E
55.,1.185E5,1.052E5,95480.,88310.,1.475E5,1.334E5,1.198E5,1.104E5,1.
6031E5,1.392E5,1.385E5,1.295E5,1.221E5,1.157E5,8228.,8152.,8126.,81
715.,8662.,8471.,8404.,8375.,9353.,8927.,8778.,8712.,10480.,9573.,9
8270.,9183.,12400.,10580.,10020.,9870.,15230.,12180.,11200.,10870.,
91940.,14530.,12910.,12310.,25360.,17840.,15310.,14330.,33440.,
DATAAG/22350.,18570.,17060.,44000.,28280.,52530.,45520.,1.254E5,180750.,62840.,54710.,
2,37570.,1.087E5,67930.,52530.,45520.,1.254E5,180750.,62840.,54710.,
31,379E5,93410.,73770.,64460.,8133.,8109.,8100.,9361.,8782.,8680.,1
41980.,10510.,10020.,18540.,14610.,13040.,32050.,22970.,19110.,5478
50.,37240.,129540.,85300.,57510.,44840.,8095.,8104.,8134.,8907.,8644
6.,8623.,10850.,9593.,9359.,15300.,11650.,10800.,24520.,15650.,1348
70.,40400.,22530.,18030.,63360.,32820.,24890.,8076.,8252.,8422.,862
83.,8758.,8929.,9388.,9299.,9515.,11020.,10350.,10310.,14210.,12020
9.,11610.,119620.,14860.,13760.,27790.,19110.,16960.,/
P=PRES
IF (P-LT.1.0) P=1.0
T=TEMP
IF (T-GE.6000.) T=5999.9999
DIV=1.0
IF (T-GE.100.0) GO TO 15
T=24.84+.00317*P
IF (T-LT.TZ) T=TZ
IF (P-GE.700.0) GO TO 4
IF (T-GE.80.0) GO TO 3
IF (P-LT.187.506) GO TO 7
IF (T-LT.56.0) GO TO 12
IF (P-GT.400.0) GO TO 2
TM=(-0.0000523467*P+0.08698291)*P+44.8824+1
IF (T-GE.TM) GO TO 1
N=7
DIV=((P-187.506)*.083+TM-7)/10.
GO TO 33
1 N=8
DIV=((P-187.506)*.083+TM-7)/10.
GO TO 33
2 N=9
GO TO 33
3 N=11
GO TO 33
4 IF (P-GE.2500.0) GO TO 6
IF (T-GE.60.0) GO TO 5
N=2
GO TO 33
5 N=10
GO TO 33
6 N=3
GO TO 33
7 DO 8 I=2,19
IF (P-PS(I)) 10,9,8
8 CONTINUE
9 TM=TS(I)
GO TO 11
10 TM=TS(I-1)+(TS(I)-TS(I-1))*(P-PS(I-1))/(PS(I)-PS(I-1))
11 IF (T-GE.TM) GO TO 13
IF (T-LT.56.0) GO TO 12
N=6

```

```

J=I+JP(N)
ETLFAC=(FP*FT*C(I)+F*FT*C(I+1)+FP*FF*C(J)+F*FF*C(J+1))/DIV
RETURN
END

SUBROUTINE ETLFAC
COMMON/ETLFAC/C(1730)
DATA(C(1),1=291,382)=0.,0.,3468.9,4953.9,7489.,9139.6,10763.,0.,5
1876.2,6208.0,7990.0,10865.1,13358.5,16733.9,20718.5,25101.6,30100.
245.3,12429.1,33442.8,8443.4,9360.4,10558.5,12037.5,13675.3,15167.1
38108.1,11865.6,12169.5,13488.1,14995.1,16578.1,18287.7,20077.1,21953.1
45072.1,16477.1,18007.1,1919.6,4844.3,781.5,727.7,6880.7,4639.4,601
5.5,5324.7,5214.4,5127.9,5056.3,4944.5,4898.3,5003.6,5615.4,
6848.1,5391.5,5312.8,5246.9,5190.7,6463.8,6111.7,5887.7,5736.5,563
72.5,5548.6,5478.8,7213.9,6677.5,6334.4,6128.1,5966.9,5843.2,5757.8,
87655.1,7178.6,5786.1,16511.4,6310.6,6158.6,6030.3,7466.7,7366.7,7093.6
9321.2,6616.1,6445.2,6308.3,7103.8,7225.1,7187.9,7012.4,6836.1)
DATA(C(1),1=343,476)=6675.3,6536.5,6837.3,6708.1,7071.6,7837.2,169
140.5,6821.6,6703.1,4986.4,4714.5,4558.2,4428.5,4330.2,5942.5,5464.
2,5274.7,5132.1,5021.6,6703.1,6825.1,6825.1,5007.2,5644.3,5521.7,6810.6,6433.
3,6138.6,5968.1,5840.1,6538.1,6512.1,6208.3,6128.6,5997.5,5208.8,5737.5
4,6667.1,7136.1,6703.1,5332.2,5772.2,6394.3,6062.6,6023.1,5405.3,5780.
5,6273.8,6662.9,6782.4,5435.4,5762.2,6170.2,6498.4,6665.1,5428.6,5
6717.4,6061.7,6352.7,6524.9,5428.6,6517.1,6502.1,6176.4,5597.5,5859.7
7,5747.1,5682.2,5551.3,5528.8,5597.1,5731.7,5823.1,5811.3,5761.7,5701.3,56
8,5726.1,5648.7,4936.6,5440.1,5731.7,5823.1,5811.3,5761.7,5701.3,56
9,5576.1,4736.3,5514.6,5430.1,5577.3,5628.9,5631.8,5610.9,5576.1
DATA(C(1),1=477,565)=5532.9,4595.5,4939.9,5198.5,5368.2,5462.1,55
188.9,5518.1,5502.9,5485.1,4595.5,5198.5,5368.2,5462.1,55
2498.1,5172.5,5356.8,5443.5,4947.4,5168.5,5317.7,5510.5,5485.1,4616.6
32,5388.6,5477.7,5549.9,5504.7,5489.8,5568.8,5628.6,5674.5,5710.5,5
4517.2,5648.4,6199.5,6121.7,6543.4,6442.9,7824.4,7287.7,7591.7,7898.
58,8353.1,8422.8,8353.1,8266.5,8228.2,8205.5,8190.8,8949.8,8756.8,8661.
67,8605.8,8566.4,9937.5,9467.1,9351.7,9226.1,9140.2,11741.5,10794.3,10
7425.9,10224.6,10051.3,11708.1,12948.8,12166.1,11787.4,11493.6,19346
8,316296.8,14837.4,14195.8,13636.9,126339.2,1266.2,19043.1,17801.1,
96804.8,35975.9,24310.9,24866.6,222913.9,21488.8,49030.1,37846.9)
DATA(C(1),1=566,647)=32775.9,29868.7,27826.6,26567.8,50156.3,43305
19,339803.3,36046.5,85144.3,65234.9,56102.7,50416.9,46483.8,106314.
2,82586.7,71382.8,64134.4,55914.3,126795.1,101043.8,8283.2,79430.2,7
33091.5,141891.1,118476.1,105172.1,95475.2,88308.7,147511.1,133418.1,119
4809.1,110420.1,103086.1,139166.1,138468.1,129522.1,122112.1,115660.1,8228.
51,8151.9,8125.7,8114.9,8662.1,8470.8,8404.1,8375.3,9353.8,8927.4,877
67,8712.1,10481.7,9572.8,9270.4,9183.1,12403.3,10503.9,10020.9,987
70,51522.1,12183.8,11201.1,110873.7,19412.4,14527.1,12909.7,12313.8,
825355.8,17837.8,15310.1,14327.1,13443.5,22340.2,10573.3,17057.8,439
997.5,28276.1,22868.5,20599.1,57174.6,35793.1,28343.6,25174.1)
DATA(C(1),1=568,730)=72847.1,44981.9,35104.7,30844.4,90412.1,5577
10,9,43179.4,37565.9,100692.6,7925.2,52529.3,45520.8,125426.8,80745.
26,62835.9,154707.2,137910.1,93410.4,73773.8,64455.9,8132.6,8109.8,810
38,4,9361.4,8781.8,8679.7,11979.1,10505.3,10015.7,18544.1,14607.5,130
435.5,32053.1,22965.2,19106.6,54782.1,37236.7,2954.1,3,65301.1,57507.8,
544840.5,8095.3,8103.8,8134.5,8907.2,8644.1,8625.1,10888.1,19593.1,9
6358.7,15295.1,11645.6,10798.1,124523.1,15652.3,13462.9,40401.1,122526
7,7,18032.5,63358.1,38231.8,24893.7,8075.7,8252.2,8623.4,8758.
84,8928.8,9388.4,9299.3,9514.7,11021.1,10352.3,10308.1,14212.2,12024.
93,11606.9,19619.7,14358.2,13761.4,27786.9,19107.4,16955.9)
END

```



```

FUNCTION ETSATH(TEMP, MG, HL)
  DIMENSION R(19), TL(19), TG(19), TF(19)
  DATA R/1.022,2.0,4.0,8.0,14.0,25.0,43.0,69.0,99.0,128.0,151.0,
    1165.0,176.0,182.0,185.0,186.5,187.25,187.46875,187.51012/,
    2 TG/60.35,65.19,70.69,76.60,81.50,86.38,89.99,91.24,89.18,83.90,
    3 76.55,69.46,61.16,53.87,47.96,43.01,38.21,34.66,31.225/,
    4 TL/-132.80,-129.10,-124.16,-117.53,-110.29,-100.02,-86.44,-69.5,
    5 -51.29,-33.56,-18.32,-7.62,2.73,10.26,15.84,20.35,24.71,28.00,
    6 31.225/, TF/24.849,27.091,29.821,33.079,36.190,39.975,44.129,
    7 48.332,51.965,54.796,56.725,57.792,58.580,58.991,59.191,59.291,
    8 59.340,59.354,59.356/
  T=TEMP
  IF (T.LT.24.849) T=24.845
  IF (T.GE.59.356) T=59.356
  DO 104 I=2,19
    IF (T-TF(I)) 102,101,104
  101 HL=TL(I)
    MG=TG(I)
    ETSATH=R(I)
  RETURN
  102 D=TF(I)-TF(I-1)
    TTR=TF(I)-T
    TTR=T-TF(I-1)
    HL=(TL(I)*TTR+TL(I-1)*TTR)/D
    MG=(TG(I)*TTR+TG(I-1)*TTR)/D
    ETSATH=(R(I)*TTR+R(I-1)*TTR)/D
  RETURN
  104 CONTINUE
  END

```

```

FUNCTION EPSATH(PRESS, MG, HL)
  DIMENSION R(19), TL(19), TG(19), TF(19)
  DATA R/1.022,2.0,4.0,8.0,14.0,25.0,43.0,69.0,99.0,128.0,151.0,
    1165.0,176.0,182.0,185.0,186.5,187.25,187.46875,187.51012/,
    2 TG/60.35,65.19,70.69,76.60,81.50,86.38,89.99,91.24,89.18,83.90,
    3 76.55,69.46,61.16,53.87,47.96,43.01,38.21,34.66,31.225/,
    4 TL/-132.80,-129.10,-124.16,-117.53,-110.29,-100.02,-86.44,-69.5,
    5 -51.29,-33.56,-18.32,-7.62,2.73,10.26,15.84,20.35,24.71,28.00,
    6 31.225/, TF/24.849,27.091,29.821,33.079,36.190,39.975,44.129,
    7 48.332,51.965,54.796,56.725,57.792,58.580,58.991,59.191,59.291,
    8 59.340,59.354,59.356/
  P=PRESS
  IF (P.LT.1.022) P=1.022
  IF (P.GE.187.506) P=187.506
  DO 104 I=2,19
    IF (P-R(I)) 102,101,104

```

```

FUNCTION ETSATH(TEMP, MG, HL)
  DIMENSION R(19), TL(19), TG(19), TF(19)
  DATA R/1.022,2.0,4.0,8.0,14.0,25.0,43.0,69.0,99.0,128.0,151.0,
    1165.0,176.0,182.0,185.0,186.5,187.25,187.46875,187.51012/,
    2 TG/60.35,65.19,70.69,76.60,81.50,86.38,89.99,91.24,89.18,83.90,
    3 76.55,69.46,61.16,53.87,47.96,43.01,38.21,34.66,31.225/,
    4 TL/-132.80,-129.10,-124.16,-117.53,-110.29,-100.02,-86.44,-69.5,
    5 -51.29,-33.56,-18.32,-7.62,2.73,10.26,15.84,20.35,24.71,28.00,
    6 31.225/, TF/24.849,27.091,29.821,33.079,36.190,39.975,44.129,
    7 48.332,51.965,54.796,56.725,57.792,58.580,58.991,59.191,59.291,
    8 59.340,59.354,59.356/
  T=TEMP
  IF (T.LT.24.849) T=24.845
  IF (T.GE.59.356) T=59.356
  DO 104 I=2,19
    IF (T-TF(I)) 102,101,104
  101 HL=TL(I)
    MG=TG(I)
    ETSATH=R(I)
  RETURN
  102 D=TF(I)-TF(I-1)
    TTR=TF(I)-T
    TTR=T-TF(I-1)
    HL=(TL(I)*TTR+TL(I-1)*TTR)/D
    MG=(TG(I)*TTR+TG(I-1)*TTR)/D
    ETSATH=(R(I)*TTR+R(I-1)*TTR)/D
  RETURN
  104 CONTINUE
  END

```

```

FUNCTION EPSATH(PRESS, MG, HL)
  DIMENSION R(19), TL(19), TG(19), TF(19)
  DATA R/1.022,2.0,4.0,8.0,14.0,25.0,43.0,69.0,99.0,128.0,151.0,
    1165.0,176.0,182.0,185.0,186.5,187.25,187.46875,187.51012/,
    2 TG/60.35,65.19,70.69,76.60,81.50,86.38,89.99,91.24,89.18,83.90,
    3 76.55,69.46,61.16,53.87,47.96,43.01,38.21,34.66,31.225/,
    4 TL/-132.80,-129.10,-124.16,-117.53,-110.29,-100.02,-86.44,-69.5,
    5 -51.29,-33.56,-18.32,-7.62,2.73,10.26,15.84,20.35,24.71,28.00,
    6 31.225/, TF/24.849,27.091,29.821,33.079,36.190,39.975,44.129,
    7 48.332,51.965,54.796,56.725,57.792,58.580,58.991,59.191,59.291,
    8 59.340,59.354,59.356/
  P=PRESS
  IF (P.LT.1.022) P=1.022
  IF (P.GE.187.506) P=187.506
  DO 104 I=2,19
    IF (P-R(I)) 102,101,104

```

```

FUNCTION ETSATH(TEMP, MG, HL)
  DIMENSION R(19), TL(19), TG(19), TF(19)
  DATA R/1.022,2.0,4.0,8.0,14.0,25.0,43.0,69.0,99.0,128.0,151.0,
    1165.0,176.0,182.0,185.0,186.5,187.25,187.46875,187.51012/,
    2 TG/60.35,65.19,70.69,76.60,81.50,86.38,89.99,91.24,89.18,83.90,
    3 76.55,69.46,61.16,53.87,47.96,43.01,38.21,34.66,31.225/,
    4 TL/-132.80,-129.10,-124.16,-117.53,-110.29,-100.02,-86.44,-69.5,
    5 -51.29,-33.56,-18.32,-7.62,2.73,10.26,15.84,20.35,24.71,28.00,
    6 31.225/, TF/24.849,27.091,29.821,33.079,36.190,39.975,44.129,
    7 48.332,51.965,54.796,56.725,57.792,58.580,58.991,59.191,59.291,
    8 59.340,59.354,59.356/
  T=TEMP
  IF (T.LT.24.849) T=24.845
  IF (T.GE.59.356) T=59.356
  DO 104 I=2,19
    IF (T-TF(I)) 102,101,104
  101 HL=TL(I)
    MG=TG(I)
    ETSATH=R(I)
  RETURN
  102 D=TF(I)-TF(I-1)
    TTR=TF(I)-T
    TTR=T-TF(I-1)
    HL=(TL(I)*TTR+TL(I-1)*TTR)/D
    MG=(TG(I)*TTR+TG(I-1)*TTR)/D
    ETSATH=(R(I)*TTR+R(I-1)*TTR)/D
  RETURN
  104 CONTINUE
  END

```

```

FUNCTION EPSATH(PRESS, MG, HL)
  DIMENSION R(19), TL(19), TG(19), TF(19)
  DATA R/1.022,2.0,4.0,8.0,14.0,25.0,43.0,69.0,99.0,128.0,151.0,
    1165.0,176.0,182.0,185.0,186.5,187.25,187.46875,187.51012/,
    2 TG/60.35,65.19,70.69,76.60,81.50,86.38,89.99,91.24,89.18,83.90,
    3 76.55,69.46,61.16,53.87,47.96,43.01,38.21,34.66,31.225/,
    4 TL/-132.80,-129.10,-124.16,-117.53,-110.29,-100.02,-86.44,-69.5,
    5 -51.29,-33.56,-18.32,-7.62,2.73,10.26,15.84,20.35,24.71,28.00,
    6 31.225/, TF/24.849,27.091,29.821,33.079,36.190,39.975,44.129,
    7 48.332,51.965,54.796,56.725,57.792,58.580,58.991,59.191,59.291,
    8 59.340,59.354,59.356/
  P=PRESS
  IF (P.LT.1.022) P=1.022
  IF (P.GE.187.506) P=187.506
  DO 104 I=2,19
    IF (P-R(I)) 102,101,104

```

```

FUNCTION ETSATH(TEMP, MG, HL)
  DIMENSION R(19), TL(19), TG(19), TF(19)
  DATA R/1.022,2.0,4.0,8.0,14.0,25.0,43.0,69.0,99.0,128.0,151.0,
    1165.0,176.0,182.0,185.0,186.5,187.25,187.46875,187.51012/,
    2 TG/60.35,65.19,70.69,76.60,81.50,86.38,89.99,91.24,89.18,83.90,
    3 76.55,69.46,61.16,53.87,47.96,43.01,38.21,34.66,31.225/,
    4 TL/-132.80,-129.10,-124.16,-117.53,-110.29,-100.02,-86.44,-69.5,
    5 -51.29,-33.56,-18.32,-7.62,2.73,10.26,15.84,20.35,24.71,28.00,
    6 31.225/, TF/24.849,27.091,29.821,33.079,36.190,39.975,44.129,
    7 48.332,51.965,54.796,56.725,57.792,58.580,58.991,59.191,59.291,
    8 59.340,59.354,59.356/
  T=TEMP
  IF (T.LT.24.849) T=24.845
  IF (T.GE.59.356) T=59.356
  DO 104 I=2,19
    IF (T-TF(I)) 102,101,104
  101 HL=TL(I)
    MG=TG(I)
    ETSATH=R(I)
  RETURN
  102 D=TF(I)-TF(I-1)
    TTR=TF(I)-T
    TTR=T-TF(I-1)
    HL=(TL(I)*TTR+TL(I-1)*TTR)/D
    MG=(TG(I)*TTR+TG(I-1)*TTR)/D
    ETSATH=(R(I)*TTR+R(I-1)*TTR)/D
  RETURN
  104 CONTINUE
  END

```

```

FUNCTION EPSATH(PRESS, MG, HL)
  DIMENSION R(19), TL(19), TG(19), TF(19)
  DATA R/1.022,2.0,4.0,8.0,14.0,25.0,43.0,69.0,99.0,128.0,151.0,
    1165.0,176.0,182.0,185.0,186.5,187.25,187.46875,187.51012/,
    2 TG/60.35,65.19,70.69,76.60,81.50,86.38,89.99,91.24,89.18,83.90,
    3 76.55,69.46,61.16,53.87,47.96,43.01,38.21,34.66,31.225/,
    4 TL/-132.80,-129.10,-124.16,-117.53,-110.29,-100.02,-86.44,-69.5,
    5 -51.29,-33.56,-18.32,-7.62,2.73,10.26,15.84,20.35,24.71,28.00,
    6 31.225/, TF/24.849,27.091,29.821,33.079,36.190,39.975,44.129,
    7 48.332,51.965,54.796,56.725,57.792,58.580,58.991,59.191,59.291,
    8 59.340,59.354,59.356/
  P=PRESS
  IF (P.LT.1.022) P=1.022
  IF (P.GE.187.506) P=187.506
  DO 104 I=2,19
    IF (P-R(I)) 102,101,104

```

```

101 ML=TL(I)
    HG=TG(I)
    EPSATH=TF(I)
    RETURN
102 D=RI(I)-R(I-1)
    PPR=R(I)-P
    PPR=P-R(I-1)
    ML=TL(I)*PPR
    HG=TG(I)*PPR
    EPSATH=(TF(I)
    RETURN
104 CONTINUE
    RETURN
END

```

FUNCTION EHTEMP (PRES, ENTH, QUAL)

```

DIMENSION LOC(16), JP(13),
      ,RI(9),TL(19),TG(19),TF(19),SH(10),TS(10),TC(29)
DIMENSION AA(16),AB(11),AC(112),AD(90)
EQUIVALENCE (T,AA), (T(1),AB), (T(2),AC), (T(3),AD)
DATA R/1.022,2,0.4,0.8,0.4,0.25,0.4,3.0,69.0,99.0,1.8,0.151,0,
165.0,176.0,182.0,185.0,186.5,187.25,187.6875,187.51012,
DATA LG/60.35,65.15,70.67,76.60,81.50,86.38,89.91,93.12,96.99,100.48,99.18,93.43
0.76,95.63,46.61,16.93,87.7,96.43,31.138,1.3,66,31.225,
DATA T/1.132,60,129,10,12,16,17,53,1,10,29,100,0,2,96.44,-63
0.5,51.29,33.56,18.32,7.62,2.10,26,15.84,20.35,24.71,28.03,
33.1,225/
DATA TF /24.845,27.091,29.821,33.079,36.190,39.975,44.129,
48.332,51.965,54.796,56.725,57.792,58.580,59.994,59.194,59.4291,
59.340,59.354,59.35867/
DATA SH /-132.81,-109.93,-87.52,-65.56,-44,-22.76,-1.79,16.99,
39.60,60.077,152.4,845,27.17,29.308,31.298,33.175,34.962,
36.572,38.316,39.904,41.427/
DATA LOC/1,100,118,150,4,178,218,9,283,331,340,358,376,400,406,
418/
DATA JP/11,3,8,7,11,8,13,11,8,3,3,3,4/
DATA MX/0.1,6,9,6,11,1,6,1,1,1,2/
DATA BP/0.0,0.881,76.0,587.84,881.76,0.0,73.43,0.0,-40.0,-2.0,
1500.0/
DATA BP/3000.0,750.0,587.84,1146.96,440.88,587.84,73.43,893.32,
73.43,1500.0,123.0,6.0,1000.0/
DATA GH/1800.0,425.0,170.61,170.61,-110.0,9.42,65.42,65,-134.4,
-53.32,1000.0,1000.0,1000.0,425.0,2000.0,2000.0/
DATA DH/3000.0,275.0,85.306,85.306,119.194,31.939,31.99,20.26,15.19,
500.0,200.0,2000.0,275.0/
DATA AA/26.66,17.68,9.108,0.0,0.935,51.9,42.4,20,18.2,9,12.78,37.
3,29.94,21.2,13.2,0.0,1.400,1.379,35.05,44.51,39.95,33
-24.7,17.11,0.2236,2216.42,5.39,63.36,2.50,44.46,42.1,35.71
28.27,20.9,3019,3006.47,55.46,44.4,1255.1,52.91,49.26,44.56,
38.58,31.47,24.53,0.51,44.8451,71.50,43,59,153,457,95,5,13,51.45,46.2
99,44.1,36.34,52,27,31,15,0,1,60,31,52,44,60,18,37,13,153,45,49.2
3,44,0,2,7,55,33,68,24,21,0.1,66,49,166,44,164,72,62,21,53,15,55,53,5
3,44,56,57,40,64,34,84,27,91,69,47,70,17,168,89,66,76,65,11,161,105,5

```

```

07.56,53.6,49.01,43.55,37.31,120.0,134.1,140.1,149.4,205.5,209.9,285.
9,3,287,2,287,4,371,369,9,368,1,453,9,451,2,448,6,545,5,531,4,7
DATA65/927,7,90,45,92,62,91,82,69,83,87,2,68,4,19,9,80,31,7,7,4,103,8,
1107,5,107,8,106,5,104,4,101,6,98,9,95,86,118,9,123,2,124,3,123,6,
2121,9,119,7,117,7,114,4,136,1,140,5,142,2,141,8,140,5,138,5,136,1,133
31,161,9,70,69,77,7,82,88,86,46,88,86,90,45,82,18,87,4,92,16,96,1,
46,99,36,101,9,103,8,101,2,105,2,100,8,111,9,114,7,117,1,118,9,121,4,
5,124,6,127,45,130,1,132,4,134,4,136,1,170,2,7,66,89,65,93,62,11,57,56
6,52,15,45,49,37,78,75,72,75,31,73,01,69,86,66,14,61,9,57,0,51,86,
180,79,81,3,79,55,76,36,7,64,70,65,99,61,53,95,65,87,03,85,74,83,
8,86,80,57,77,31,73,75,69,9,98,45,92,62,91,82,89,83,87,2,84,19,80,91
9,97,44,117,81,82,56,7,61,51,64,78,66,76,68,0,66,89,69,47,69,9,85/
DATAAC70,7,70,23,70,27,30,31,45,53,56,18,62,62,66,86,69,7,71,16,3,7
12,98,73,95,74,46,4,75,14,75,49,75,72,42,51,52,13,59,5,65,21,69,52,72
2,77,75,05,76,79,78,09,79,07,78,81,80,37,80,79,53,59,33,64,73,69,35
3,73,18,76,27,78,73,80,67,62,19,83,39,84,33,85,07,85,65,61,94,66,52
4,70,69,74,43,77,7,80,52,82,88,84,86,46,87,78,88,86,9,74,90,45,
55,1,51,76,51,84,15,17,15,1,51,22,50,86,50,44,54,11,54,93,55,46,
55,51,75,78,52,75,56,55,33,56,63,56,91,58,12,58,92,59,32,59,52,15
59,59,53,0,57,49,60,03,61,4,62,27,62,77,63,07,63,21,0,57,3,61
81,163,34,64,72,65,59,66,14,66,49,0,56,7,61,51,64,78,66,76,68,0,
81,163,34,64,72,65,59,66,14,66,49,0,56,7,61,51,64,78,66,76,68,0,
86,8,86,46,87,78,88,86,9,74,90,45,
DATAAD/2818,2818,2809,2809,2800,0,038,4046,4040,4984,5120,5140,1/
4,438,4,4259,1,4349,4,4612,4,4659,1,4530,4,922,5,002,2,816,2,818,
2,3295,3,3316,3,3320,3,3665,3,3756,3,3777,3,3912,4,407,4,459,4,483,4,373,
3,4458,4,4212,4,4578,4,4693,1,140,1,141,6,135,1,139,2,209,209,9,208,2,
2205,1,287,4,286,2,283,1,279,4,368,1,364,9,360,9,356,4,448,2,443,9,14
3,14,434,527,7,522,5,517,2,511,7,4984,5120,5140,5605,4549,150
227,4530,4922,5002,4671,5179,5293,4786,5396,550,4885,165
61,5754,4212,4578,4693,4316,4743,4883,4403,4860,5040,144
79,4997,5175,7/
P=PRES
IF(P,LT,1.0) P=1.0
ME=ENTH
IF(H,GE,25000.0) H=24999.99999
Q=1.0
IF(H,LT,42.65) GO TO 10
IF(H,GE,170.61) GO TO 1
N=6
GO TO 2
IF(H,GE,426.53) GO TO 3
N=3
IF(P,LT,881.76) N=N+1
GO TO 15
IF(H,GE,1800.0) GO TO 4
N=2
IF(P,GE,1500.0) N=N+3
GO TO 20
IF(H,GE,10800.0) GO TO 5
N=1
GO TO 20
IF(P,LE,200.0) GO TO 6
N=10
N=14
GO TO 20
IF(P,LE,11.0) GO TO 7
N=11
N=15

```

```

I=PR=P/587.84
IF(I.GT.8) I=8
F=PR-I
FP=1.0-F
MS=FP*SH(I+1)+F*SH(I+2)
TQ=FP*TS(I+1)+F*TS(I+2)
IF(M.LT.HS) GO TO 17
IF(P.GT.187.51012) GO TO 20
IF(P.LT.1.021) GO TO 105
DO 104 I=2,19
IF(P-R(I))102,101,104
101 ML=TL(I)
MG=TG(I)
TQ=TF(I)
GO TO 106
102 D=R(I)-R(I-1)
PPR=R(I)-P
PPR=P-R(I-1)
ML=(TL(I)*PPR+TL(I-1)*PPR)/D
MG=(TG(I)*PPR+TG(I-1)*PPR)/D
TQ=(TF(I)*PPR+TF(I-1)*PPR)/D
GO TO 106
104 CONTINUE
105 ML=-132.8
MG=60.31
TQ=24.84
GO TO 16
106 IF(M.GT.HL) GO TO 16
Q=0.0
GO TO 20
16 IF(M.GT.HG) GO TO 20
Q=(M-HL)/(HG-HL)
GO TO 30
17 Q=(M-HS)/(C.0026806*P+25.021)
GO TO 30
20 IF(M.LE.20000.)N1=N
FP=(P-BP(N))/DP(N)
IP=FP
IF(IP.GT.MX(N)) IP=MX(N)
F=FP-IP
FP=1.0-F
FM=(M-BH(N1))/DH(N)
IM=FM
FF=FM-IM
FH=1.0-FF
I=IM*JP(N)+IP*LOC(N1)
J=I*JP(N)
TQ=FP*FM*(I)+F*FM*(I-1)+FP*FF*(J)+F*FF*(J+1)
30 QUAL=Q
EXITMP=TQ
RETURN
END

SUBROUTINE EEMPDATA
COMMON /EEMPTR/ T(429)
DATA(T(I),I=333,429)=2800.,4078.,4046.,4040.,4984.,5120.,5140.,28
118.,2818.,2817.,3317.,3324.,3325.,3758.,3803.,3809.,4102.,4238.,42
259.,4349.,4612.,4859.,4930.,4922.,5002.,2816.,2817.,42818.,3295.,33
316.,3320.,3665.,3756.,3777.,3912.,4107.,4159.,4083.,4373.,4458.,42

```

```

412..4578..4693..140.1.1.1.6.135.1.139.2.209..209.9.208.2.205.1.287
9.4.286..283.1.279.4.368.1.364.9.360.9.356.4.448.2.443.9.439.1.434.
6.527.5.522.5.517.2.511.7.498.4.5128..5118..5685..5949..6027..4530.
7.4922..5002..4671..5179..5293..4786..5396..5540..4885..5581..5759.
8.4212..4578..4693..4316..4743..4883..4403..4880..5040..4479..4997.
9.5175.)
RETURN
END

```

```

FUNCTION EMDENS(PRES,ENTH)
COMMON /EMDENS/IR(612)
DIMENSION PD(19),ML(19),MG(19),RL(19),RG(19),MS(11),RS(11),LOC(19)
1,JP(16),DP(16),DM(16),BP(16),BH(19),MX(16),R(612)
DIMENSION AI(82),AB( 92),AC(109),AD(116),AE(109),AF(101),AG( 3)
EQUIVALENCE( R,AA),( R( 83),AB),( R( 175),AC),( R( 284),AD)
1, ( R( 400),AE),( R( 509),AF),( R( 610),AG)
DATA AA/-0.663,-0.6638,-1.967,-0.5622,-0.5628,-1.671,-0.4902,-0.4909,-.14
158,-.04363,-0.4374,-1.299,-.0395,-.03967,-1.176,-.03628,-0.3651,-1.08,2.
2753E-7,.003338,-0.0667,8.955E-7,.00283,-0.05656,3.24E-6,-.002474,.00
3494,7.326E-6,.002219,-0.04421,-1.48E-5,-.002036,-0.04041,1.465E-5,.00
41899,-0.03757,2.748E-8,-.0003339,-0.006678,8.722E-8,-.0003063,-0.006123
512.199E-7,-.0002835,-.0005664,4.22E-7,-.0002649,-.0005288,7.277E-7,0
6002495,-.0004973,1.026E-6,-.0002369,-.0004713,1.292E-6,-.0002266,-.0004
797,1.512E-6,-.000218,-.0004317,1.687E-6,-.0002106,-.000416,1.822E-6,
8.002043,-.0004031,1.926E-6,-.0001987,-.0003916,-.1274,-.1277,-.3745,-.
9107,-1.072,-3.153,-.09237,-.09252,-.09259,-.08148,-.08159,-.2412,-.07303/
OAT AAB/7.01733,2.165,-.0663,-0.6638,-1.967,1.459E-7,-.0129,1.016E-7,0
11081,7.554E-8,-.000321,5.96E-8,-.008213,5.436E-8,-.007356,7.258E-8,0
206674,-.003325,3.406,-6601,-.9603,-.002244,-.2813,-.5484,-.802,-.001612,
32399,-.4694,-.8891,-.001212,-.2091,-.4104,-.6042,-.0009432,-.1854,-.3646,.5
4379,-.0007546,-.1665,-.3781,-.4488,-.0006183,-.1512,-.2983,-.4413,-.0005159
5,-.1384,-.2735,-.4051,-.0004374,-.1277,-.2525,-.3745,-.159E-6,-.03506,-.069
609,-.1045,-.7744E-7,-.02831,-.05747,-.08597,5.516E-7,-.02448,-.04884,-.073
71,4.119E-7,-.02128,-.04248,-.06359,3.189E-7,-.01882,-.03759,-.05628,-.2.54
8E-7,-.01688,-.03371,-.05049,-.2.074E-7,-.0153,-.03056,-.04578,-.1725E-7,-.01
94,-.02796,-.04189,-.1.459E-7,-.0129,-.02578,-.03862,-.739,-.1.835,-.2.85/
OAT AAC/3.205,3.663,4.031,5.533,-.447,-.2165,-.7143,-.189,3.549,-.4282,
11.151,-.1768,-.2428,-.2.7143,-.087,-.3469,-.9512,-.1.484,-.1.955,-.2.361,-.2.719,
2.291,-.809,1.28,1.702,-.2.079,-.2.417,-.2508,-.7045,-.1.123,-.1.505,-.1.853,-.2.1
37,-.2209,-.625,-.002,1.35,1.671,-.1.968,-.1977,-.5627,-.995,-.1.225,-.1.523,
41.801,-.1792,-.5124,-.8275,-.1.123,-.41,-.661,-.164,-.4709,-.762,-.1.037,-.1.2
597,-.1.542,-.1514,-.436,-.7074,-.9646,-.1.208,-.1.44,-.1406,-.4061,-.6601,-.9018
6,-.1.132,-.1.351,-.5164,-.2582,-.1.013,-.402,-.201,-.7765,-.3155,-.1578,-.608
79,-.2573,-.1287,-.498,-.2164,-.1082,-.4205,-.1863,-.09342,-.3643,-.1647,
9.08233,-.3219,-.1475,-.07373,-.289,-.1337,-.06686,-.2625,-.1224,-.0.123,
2.408,-.113,-.05652,-.2225,-.105,-.0525,-.207,-.849,-.331,-.747,-.6.3/
DATA AD/6.6,3.907,4.519,4.995,5.405,-.634,3.149,3.913,4.46,4.866,5,
12.2473,3.365,3.995,4.468,4.808,1.937,8.64,3.548,4.046,4.441,5.532
2.43,3.126,3.654,071.5,2.5,5.7,0.4668,4.698,5.45,3.4178,4.43
3,4.6454,-.836,7.26,4.03,4.277,4.45,3.276,3.666,3.95,4.177,2.826,3
4.308,3.64,-.789,3.124,-.1.523,-.2.112,-.544,-.2.891,-.1.343,-.1.886,-.2.32,-.67
5751,-.2366,-.2.789,3.124,-.1.523,-.2.112,-.544,-.2.891,-.1.343,-.1.886,-.2.32,-.67
61,-.1.197,-.1.702,-.2.12,-.2.468,-.1.078,-.1.544,-.1.943,-.2.283,-.9789,-.1.409,-.1.786
7,2.114,-.8799,-.1.292,-.1.647,-.1.361,-.4.581,-.4.678,-.4.772,-.4.861,-.4.9,5.5,5.1,

```

```

FUNCTION EMDENS(PRES,ENTH)
DIMENSION PD(19),ML(19),MG(19),RL(19),RG(19),MS(11),RS(11),LOC(19)
1,JP(16),DP(16),DM(16),BP(16),BH(19),MX(16),R(612)
DIMENSION AI(82),AB( 92),AC(109),AD(116),AE(109),AF(101),AG( 3)
EQUIVALENCE( R,AA),( R( 83),AB),( R( 175),AC),( R( 284),AD)
1, ( R( 400),AE),( R( 509),AF),( R( 610),AG)
DATA AA/-0.663,-0.6638,-1.967,-0.5622,-0.5628,-1.671,-0.4902,-0.4909,-.14
158,-.04363,-0.4374,-1.299,-.0395,-.03967,-1.176,-.03628,-0.3651,-1.08,2.
2753E-7,.003338,-0.0667,8.955E-7,.00283,-0.05656,3.24E-6,-.002474,.00
3494,7.326E-6,.002219,-0.04421,-1.48E-5,-.002036,-0.04041,1.465E-5,.00
41899,-0.03757,2.748E-8,-.0003339,-0.006678,8.722E-8,-.0003063,-0.006123
512.199E-7,-.0002835,-.0005664,4.22E-7,-.0002649,-.0005288,7.277E-7,0
6002495,-.0004973,1.026E-6,-.0002369,-.0004713,1.292E-6,-.0002266,-.0004
797,1.512E-6,-.000218,-.0004317,1.687E-6,-.0002106,-.000416,1.822E-6,
8.002043,-.0004031,1.926E-6,-.0001987,-.0003916,-.1274,-.1277,-.3745,-.
9107,-1.072,-3.153,-.09237,-.09252,-.09259,-.08148,-.08159,-.2412,-.07303/
OAT AAB/7.01733,2.165,-.0663,-0.6638,-1.967,1.459E-7,-.0129,1.016E-7,0
11081,7.554E-8,-.000321,5.96E-8,-.008213,5.436E-8,-.007356,7.258E-8,0
206674,-.003325,3.406,-6601,-.9603,-.002244,-.2813,-.5484,-.802,-.001612,
32399,-.4694,-.8891,-.001212,-.2091,-.4104,-.6042,-.0009432,-.1854,-.3646,.5
4379,-.0007546,-.1665,-.3781,-.4488,-.0006183,-.1512,-.2983,-.4413,-.0005159
5,-.1384,-.2735,-.4051,-.0004374,-.1277,-.2525,-.3745,-.159E-6,-.03506,-.069
609,-.1045,-.7744E-7,-.02831,-.05747,-.08597,5.516E-7,-.02448,-.04884,-.073
71,4.119E-7,-.02128,-.04248,-.06359,3.189E-7,-.01882,-.03759,-.05628,-.2.54
8E-7,-.01688,-.03371,-.05049,-.2.074E-7,-.0153,-.03056,-.04578,-.1725E-7,-.01
94,-.02796,-.04189,-.1.459E-7,-.0129,-.02578,-.03862,-.739,-.1.835,-.2.85/
OAT AAC/3.205,3.663,4.031,5.533,-.447,-.2165,-.7143,-.189,3.549,-.4282,
11.151,-.1768,-.2428,-.2.7143,-.087,-.3469,-.9512,-.1.484,-.1.955,-.2.361,-.2.719,
2.291,-.809,1.28,1.702,-.2.079,-.2.417,-.2508,-.7045,-.1.123,-.1.505,-.1.853,-.2.1
37,-.2209,-.625,-.002,1.35,1.671,-.1.968,-.1977,-.5627,-.995,-.1.225,-.1.523,
41.801,-.1792,-.5124,-.8275,-.1.123,-.41,-.661,-.164,-.4709,-.762,-.1.037,-.1.2
597,-.1.542,-.1514,-.436,-.7074,-.9646,-.1.208,-.1.44,-.1406,-.4061,-.6601,-.9018
6,-.1.132,-.1.351,-.5164,-.2582,-.1.013,-.402,-.201,-.7765,-.3155,-.1578,-.608
79,-.2573,-.1287,-.498,-.2164,-.1082,-.4205,-.1863,-.09342,-.3643,-.1647,
9.08233,-.3219,-.1475,-.07373,-.289,-.1337,-.06686,-.2625,-.1224,-.0.123,
2.408,-.113,-.05652,-.2225,-.105,-.0525,-.207,-.849,-.331,-.747,-.6.3/
DATA AD/6.6,3.907,4.519,4.995,5.405,-.634,3.149,3.913,4.46,4.866,5,
12.2473,3.365,3.995,4.468,4.808,1.937,8.64,3.548,4.046,4.441,5.532
2.43,3.126,3.654,071.5,2.5,5.7,0.4668,4.698,5.45,3.4178,4.43
3,4.6454,-.836,7.26,4.03,4.277,4.45,3.276,3.666,3.95,4.177,2.826,3
4.308,3.64,-.789,3.124,-.1.523,-.2.112,-.544,-.2.891,-.1.343,-.1.886,-.2.32,-.67
5751,-.2366,-.2.789,3.124,-.1.523,-.2.112,-.544,-.2.891,-.1.343,-.1.886,-.2.32,-.67
61,-.1.197,-.1.702,-.2.12,-.2.468,-.1.078,-.1.544,-.1.943,-.2.283,-.9789,-.1.409,-.1.786
7,2.114,-.8799,-.1.292,-.1.647,-.1.361,-.4.581,-.4.678,-.4.772,-.4.861,-.4.9,5.5,5.1,

```

[illegible]

```

12 IF(M.LT.250) GO TO 13
N=13
GO TO 33
13 IF(P.LT.300.0)GO TO 14
N=14
GO TO 33
14 IF(M.LT.150.0) GO TO 15
N=15
GO TO 33
15 N=16
GO TO 33
16 PR=P/500.0
I=PR
IF(I.GT.9)I=9
F=PR-I
FP=1.0-F
HSOL=FP*HS(I+1)+F*HS(I+2)
IF(M.LT.MSOL) H=HSOL
ENDMS=FP*RS(I+1)+F*RS(I+2)
IF(M.EQ.MSOL) RETURN
IF(P.GE.600.0) GO TO 10
IF(M.LT.0.0) GO TO 10
IF(P.LT.300.0)GO TO 17
N=14
GO TO 33
17 N=16
GO TO 19
18 N=12
19 IF(P.GE.197.51012) GO TO 33
DO 20 I=2,19
IF(P-PD(I))21,21,20
20 CONTINUE
21 D=PD(I)-PD(I-1)
DF=PD(I)-P
DB=P-PD(I-1)
HLIQ=(HL(I)*DB+HL(I-1)*DF)/D
IF(M.LE.HLIQ) GO TO 33
MGAS=(HG(I)*DB+HG(I-1)*DF)/D
IF(M.GE.MGAS) GO TO 33
RLIQ=(RL(I)*DB+RL(I-1)*DF)/D
ENDMS=RLIQ/(M-HLIQ)/(MGAS-HLIQ)*(RLIQ*D/(RG(I)*DB+RG(I-1)*DF)-1.
1)+1.)
RETURN
33 IF(M.LE.2000.)N1=N
FP=(P-BP(N))/DP(N)
IP=FP
IF(IP.GT.MX(N)) IP=MX(N)
F=FP-IP
FP=1.0-F
FM=(M-BM(N1))/DM(N)
IM=FM
FF=FM-IM
FN=1.0-FF
I=IM*JP(N)+IP*LOC(N1)
J=I+JP(N)
ENDMS=P*FM*H(I)+F*FM*H(I+1)+FP*FF*H(J)+F*F*H(J+1)
RETURN
END

```

```

SUBROUTINE EHROUT
COMMON /ENDENSI/R(1612)
DATA(R(1),I=277,389)=-.105,.0525,.207,.4,.849,5.331,5.747,6.316,6.3
1.987,4.519,4.999,5.405,5.634,3.149,3.913,4.466,4.866,5.2,2.473,3.336
25.3.995,4.448,4.808,1.93,2.86,3.548,4.046,4.44,1.53,2.43,3.126,3.
365,4.071,5.25,4.5,7.0,4.669,4.998,5.15,3.4,1.78,4.4,4.84,4.836
4.726,4.835,4.277,4.48,3.276,3.666,3.95,4.177,2.826,3.308,3.643,
5.897,2.405,2.978,3.342,3.629,2.043,2.658,3.057,3.371,1.751,2.366,2.
679,3.124,1.523,2.11,2.54,2.891,1.343,1.886,2.32,2.671,1.197,1.70
72.12,2.468,1.078,1.544,1.943,2.283,2.978,1.409,1.786,2.114,8.799
8.1,292,1.647,1.961,4.581,4.676,4.772,4.861,4.945,5.13,9.84,4.041,
94.159,4.266,4.363,4.453,4.538,3.3,3.83,3.546,3.709,3.843,3.959)
DATA(R(1),I=390,496)=4.063,0.2,5.14,2.795,3.096,3.307,3.474,3.614
1.4-E-5,2.36,4.845,7.323,9.753,1.208,1.427,4.6-E-5,2.157,4.362,6.57
21.07,3.1,0.85,1.205,2-E-5,1.971,1.3968,5.961,7.921,9.827,1.166,-1.
3E-5,1.813,3.637,5.455,7.233,8.969,1.065,-1-E-5,1.675,3.351,5.013,6
4.67,8.824,9.789,0.1,1.55,3.102,4.633,6.138,7.608,9.039,3.414,3.59,3
5.718,3.838,2.927,3.166,3.35,3.502,2.398,2.731,2.972,3.162,1.3,0.2,2.
705,4.1,3.94,1.698,1.963,9.168,1.219,1.499,1.751,8.132,1.083,1.339,1.
630,2.2,597,2.826,1.518,1.926,2.246,2.505,1.245,1.624,1.947,2.215,1.
857,5.7323,9.753,1.208,1.427,6-E-5,1.62,3.341,5.116,6.932,8.755,1.
983,4-E-5,1.425,2.927,4.464,6.029,7.605,9.168,3-E-5,1.285,2.621,
DATA(R(1),I=497,600)=3.982,5.363,6.751,8.132,4-E-5,1.177,2.382,
13.607,4.885,6.087,7.323,0.0,0.0,2.589,2.795,2.962,3.096,0.0,0.0,1
2.7,2.32,2.571,2.753,0.0,0.0,3.1,86,2.169,2.398,0.0,3.71,1.1,1.113
3.1,4.98,1.804,2.059,0.0,2.9,5.708,9.156,1.225,1.509,1.76,0.0012,-23
48.4936,7.576,1.025,1.281,1.518,9-E-5,2.032,4.22,649,8.807,1.108
5.1,328,0-E-5,1.792,3.716,5.705,7.74,9.766,1.174,6-E-5,1.62,3.341
6.5,5116,6.932,8.755,1.254,-0.3628,0.3651,1.108,-0.3373,0.3403,1.0037
7.03167,0.3201,0.09402,0.2997,0.3035,0.357,1.465E-5,0.001899,0.0037
857,1.68E-5,0.01793,0.03536,1.621E-5,0.01706,0.03356,1.914E-5,0.016
933,0.03205,1.928E-6,0.001987,0.003916,2.007E-6,0.001938,0.003813)
DATA(R(1),I=601,612)=2.068E-6,0.0001893,0.00037,2.117E-6,0.001851,
1.8003635,2.154E-6,0.0001813,0.0003558,2.182E-6,0.0001778,0.0003485)
END

```

```

SUBROUTINE EHROUT
COMMON /ENDENSI/R(1612)
DATA(R(1),I=277,389)=-.105,.0525,.207,.4,.849,5.331,5.747,6.316,6.3
1.987,4.519,4.999,5.405,5.634,3.149,3.913,4.466,4.866,5.2,2.473,3.336
25.3.995,4.448,4.808,1.93,2.86,3.548,4.046,4.44,1.53,2.43,3.126,3.
365,4.071,5.25,4.5,7.0,4.669,4.998,5.15,3.4,1.78,4.4,4.84,4.836
4.726,4.835,4.277,4.48,3.276,3.666,3.95,4.177,2.826,3.308,3.643,
5.897,2.405,2.978,3.342,3.629,2.043,2.658,3.057,3.371,1.751,2.366,2.
679,3.124,1.523,2.11,2.54,2.891,1.343,1.886,2.32,2.671,1.197,1.70
72.12,2.468,1.078,1.544,1.943,2.283,2.978,1.409,1.786,2.114,8.799
8.1,292,1.647,1.961,4.581,4.676,4.772,4.861,4.945,5.13,9.84,4.041,
94.159,4.266,4.363,4.453,4.538,3.3,3.83,3.546,3.709,3.843,3.959)
DATA(R(1),I=390,496)=4.063,0.2,5.14,2.795,3.096,3.307,3.474,3.614
1.4-E-5,2.36,4.845,7.323,9.753,1.208,1.427,4.6-E-5,2.157,4.362,6.57
21.07,3.1,0.85,1.205,2-E-5,1.971,1.3968,5.961,7.921,9.827,1.166,-1.
3E-5,1.813,3.637,5.455,7.233,8.969,1.065,-1-E-5,1.675,3.351,5.013,6
4.67,8.824,9.789,0.1,1.55,3.102,4.633,6.138,7.608,9.039,3.414,3.59,3
5.718,3.838,2.927,3.166,3.35,3.502,2.398,2.731,2.972,3.162,1.3,0.2,2.
705,4.1,3.94,1.698,1.963,9.168,1.219,1.499,1.751,8.132,1.083,1.339,1.
630,2.2,597,2.826,1.518,1.926,2.246,2.505,1.245,1.624,1.947,2.215,1.
857,5.7323,9.753,1.208,1.427,6-E-5,1.62,3.341,5.116,6.932,8.755,1.
983,4-E-5,1.425,2.927,4.464,6.029,7.605,9.168,3-E-5,1.285,2.621,
DATA(R(1),I=497,600)=3.982,5.363,6.751,8.132,4-E-5,1.177,2.382,
13.607,4.885,6.087,7.323,0.0,0.0,2.589,2.795,2.962,3.096,0.0,0.0,1
2.7,2.32,2.571,2.753,0.0,0.0,3.1,86,2.169,2.398,0.0,3.71,1.1,1.113
3.1,4.98,1.804,2.059,0.0,2.9,5.708,9.156,1.225,1.509,1.76,0.0012,-23
48.4936,7.576,1.025,1.281,1.518,9-E-5,2.032,4.22,649,8.807,1.108
5.1,328,0-E-5,1.792,3.716,5.705,7.74,9.766,1.174,6-E-5,1.62,3.341
6.5,5116,6.932,8.755,1.254,-0.3628,0.3651,1.108,-0.3373,0.3403,1.0037
7.03167,0.3201,0.09402,0.2997,0.3035,0.357,1.465E-5,0.001899,0.0037
857,1.68E-5,0.01793,0.03536,1.621E-5,0.01706,0.03356,1.914E-5,0.016
933,0.03205,1.928E-6,0.001987,0.003916,2.007E-6,0.001938,0.003813)
DATA(R(1),I=601,612)=2.068E-6,0.0001893,0.00037,2.117E-6,0.001851,
1.8003635,2.154E-6,0.0001813,0.0003558,2.182E-6,0.0001778,0.0003485)
END

```

```

FUNCTION EHENTR(PRES,ENTH)
DIMENSION LOC(23),JP(20),
1,R(19),HL(19),HG(19),SL(19),SG(19),HS(10),SS(10),TS(10),S(573)
DIMENSION AA(110),AB(110),AC(115),AD(115),AE(112),AF(11)
EQUIVALENCE(S,AA),(S,111),AB,(S,111),AC),(S,111),AD)
1,(S,451),AE),(S,563),AF)
DATA(AA(6),AA(2),6,338,6.058,5.863,7.946,7.346,7.013,6.783,8.836,8.198
1.7,835,7.583,9.581,8.922,8.543,8.275,8.673,7.775,7.392,7.118,6.918
2.9,846,9.82,8.521,8.227,8.008,10.77,9.883,9.431,9.128,8.9,11.54,10
3.65,10.19,9.88,9.648,10.91,10.02,9.557,9.248,9.015,12.1,11.2,10.74
4.10,43,10.19,13.04,12.13,11.67,11.36,11.12,13.81,12.91,12.44,12.13
5.11,89,9.159,7.791,7.101,6.831,6.239,10.8,9.422,8.685,8.217,7.855
6.11,97,10.55,8.807,9.343,8.992,12.81,11.39,10.65,10.82,9.857,13.48,
7.12,86,11.30,8.910,8.915,14.03,12.63,11.9,11.46,11.13,11.33,9.965,9
8.299,8.915,13.08,11.72,11.03,10.63,14.23,12.86,12.18,11.77,15.08,1
93.7,13.02,12.61,15.74,14.37,13.69,13.28,16.3,14.93,14.25,13.84/

```

```

FUNCTION EHENTR(PRES,ENTH)
DIMENSION LOC(23),JP(20),
1,R(19),HL(19),HG(19),SL(19),SG(19),HS(10),SS(10),TS(10),S(573)
COMMON/ETRP/S(573)
DATA(S(1),I=1,100)=6.862,6.338,6.058,5.863,7.946,7.346,7.013,6.78
13.8,836,8.198,7.835,7.583,9.581,8.922,8.543,8.275,8.673,7.775,7.39
22.7,118,6.918,9.846,9.82,8.521,8.227,8.008,10.77,9.883,9.431,9.128
3.8,9,11.54,10.65,11.9,9.88,9.648,10.91,10.02,9.557,9.248,9.015,12
4.1,12,10.74,10.43,10.19,13.04,12.13,11.67,11.36,11.12,13.81,12.9
5.12,44,12.13,11.89,9.159,7.791,7.101,6.831,6.239,10.8,9.422,8.68
6.58,217,7.855,11.97,10.55,9.807,9.343,8.992,12.81,11.39,10.65,10.2
7.9,857,13.48,12.06,11.33,10.89,10.55,14.03,12.63,11.9,11.46,11.13,
8.11,33,9.965,9.298,9.915,13.08,11.72,11.03,10.63,14.23,2.86,12.18,
9.11,77,15.08,13.71,13.02,12.61,15.74,14.37,13.69,13.28,16.3,14.93)
DATA(S(1),I=109,216)=14.25,13.84,16.62,12.8,11.82,11.32,10.99,18.
106,14.67,13.59,13.08,12.75,19.21,15.82,14.74,14.23,13.9,20.05,16.6

```



[illegible]



```

FP=(P-BP(N))/DP(N)
IP=FP
IF(IP.GT.MX(N)) IP=MX(N)
F=FP-IP
FM=(N-BH(N1))/DH(N)
IM=FM
FF=FM-IM
FN=1.0-FF
J=I+JP(N)
I=IM*JP(N)+IP+LOC(N1)
ENHENTR=FP*FM*S(I)+F*FM*S(I+1)+F*FF*S(J)+F*FF*S(J+1)
RETURN
ENL

SUBROUTINE EATAENR
COMMON/EETPRY/S(573)
DATA(S(1),1=217,328)=19.77,18.41,17.72,17.32,21.39,20.03,19.34,18.19,4.22,52.21,15.20,47.20,07.23,4.22,03,21.35,20.95,24.13,22.76,22.207,21.67,24.77,23.39,22.7.22,3.24,75,21.36,20.28,19.77,19.44,26.373,22.98,21.9,21.39,21.06,27.5,24.11,23.02,22.52,22.19,28.39,24.99,243.9,23.4,23.07,29.17,25.73,24.64,24.13,23.06,29.9,26.4,25.3,24.78,254.44,4.24,7.86,2.3,473,3.18,2.763,2.402,2.023,1.616,4.732,4.329,36.975,3.642,3.315,2.992,2.662,2.324,5.183,4.776,4.431,4.112,3.806,37.506,3.206,2.902,5.605,5.9,4.85,4.542,4.25,3.967,3.687,3.408,1.2483,805,1.192,0.0,0.0,5.66,5.04,4.55,4.109,3.675,1.741,1.235,1.68,9.264,0.0,6.55,5.89,5.424,5.013,4.631,2.167,1.747,1.265,76)
DATA(S(1),1=329,441)=328.0,7.33,6.633,6.168,5.779,5.424,2.536,21.146,1.752,1.3,833,41.8,007,7.278,6.812,6.435,6.101,2.869,2.502,22.137,1.756,1.335,896,485,0,0,11.55,10.91,3.175,2.823,2.481,2.3136,1.775,1.377,96,55,0,12.69,12.1,3.463,3.118,2.792,2.471,2.2,1443.1,798,1.422,1.027,6.6,13.62,13.03,3.735,3.394,3.08,2.774,2.468,25.155,1.826,1.469,1.092,687,0,3.594,3.365,3.348,3.054,2.764,2.4716.2,171,1.856,1.516,1.155,1.155,765,4.243,3.903,3.601,3.316,3.038,2.761,72.48,2.192,1.089,1.565,1.222,4.484,4.14,3.842,3.564,3.295,3.029,2873,2.493,2.215,1.924,1.614,26,65,1.039,1.669,1.292,92,2.169,1.985,1.510,2.585,2.291,2.2,2.959,2.681,2.411,3.313,3.034,2.774)
DATA(S(1),1=442,550)=3.645,3.361,3.105,3.977,3.671,3.413,4.313,3.1968,3.703,4.623,4.255,3.979,4.971,4.536,4.243,4.531,4.303,4.118,5.0217,4.754,4.598,5.487,5.181,4.971,5.936,5.588,5.361,6.4,5.975,5.7313,0,4,803,4,712,4.709,7.265,6.426,5.911,5.642,5.468,5.332,5.252,8.4187,7.155,6.568,6.255,6.048,5.898,5.783,6.853,7.781,7.159,6.816,65585,6.415,6.281,5.409,0,0,9.923,8.455,7.786,7.431,7.187,6.995,10.8,9,3276.0,654,8.266,7.994,7.785,11.48,9.991,9.315,8.922,8.645,8.443,12.082,10.55,9.868,9.473,9.194,8.978,22.48,21.1,23.41,20.0,23.06,21.669,20.97,20.56,23.6,22.19,21.49,21.08,24.78,23.39,22.7,22.3,25.39)
DATA(S(1),1=551,572)=23.98,23.26,22.67,25.99,24.57,23.86,23.45,291.9,26.4,25.3,24.78,24.44,30.6,27.04,25.91,25.39,25.05,31.29,27.65,226.5,25.97,25.62)
END

```



158

```

14 GO TO 33
15 N=17
16 GO TO 33
17 IF (P.GT.500.) GO TO 16
18 N=16
19 GO TO 33
20 N=15
21 GO TO 33
22 DO 18 I=2,18
23 IF (P.GT.19,19,18)
24 CONTINUE
25 D=PL(I)-PL(I-1)
26 DF=PL(I)-P
27 DB=P-PL(I-1)
28 HGAS=(MG(I)*DB+MG(I-1)*DF)/D
29 IF (M.GE.HGAS) GO TO 33
30 HLIQ=(HL(I)*DB+HL(I-1)*DF)/D
31 IF (M.LE.HLIQ) GO TO 33
32 CLIQ=(CL(I)*DB+CL(I-1)*DF)/D
33 ZMCOND=(CG(I)*DB+CG(I-1)*DF)/D-CLIQ*(H-HLIQ)/(HGAS-HLIQ)*CLIQ
34 RETURN
21 N=1
35 IF (M.LE.(-132.82+0.04*P)) GO TO 22
36 IF (P.LT.-23.) GO TO 17
37 GO TO 33
38 PR=P/500.0
39 I=PR
40 IF (I.GT.9) I=9
41 F=PR-I
42 MSOL=F*MS(I+2)+(1.0-F)*MS(I+1)
43 IF (M.LT.MSOL) M=MSOL
44 GO TO 33
45 26 IF (M.LT.1800.) GO TO 27
46 N=14
47 GO TO 33
48 27 N=13
49 33 F=P-8P(N)/DP(N)
50 IP=PP
51 IF (IP.GT.MX(N)) IP=MX(N)
52 F=FP-IP
53 FP=1.0-F
54 FM=(M-8M(N))/DM(N)
55 IM=FM
56 FF=FM-IM
57 FH=1.0-FF
58 I=IM*JP(N)+IP*LOC(N)
59 J=I*JP(N)
60 EMCONO=(FP*FM*C(I)+F*FH*C(I+1)+FP*FF*C(J)+F*FF*C(J+2))*R
61 RETURN
62 END
SUBROUTINE EHLAMBDA
COMMON/EHLAMB/C(735)
DATA(C(1),I=308,402)=-.08724,.07478,0.,-.08806,.09304,.09679,.09845
1..09717,.09102,.07628,.08799,.09359,.09788,.1009,.1021,.1003,.0939
29,.08776,.09349,.09818,.102,.1048,.1056,.1034,.08742,.0934,.0984,.
31026,.106,.1085,.109,.00741,.0398,.04949,.05025,.05303,.05654,.008
476,.02201,.03919,.04702,.05146,.05533,.01061,.022,.03505,.04421,.0

```

```

54985.05414.01276.02277.03343.04222.04839.05301.05518.0240
64.03299.04101.04721.05190.05179.02554.03323.04342.04636.0
705113.0194.03171.04292.05113.02549.03423.0426.04967.0305
85.03709.04344.04919.0346.0396.04455.04919.03767.0416.045
954.04935.03989.0431.04642.04971.04159.04437.04719.05
DATA(C(I))=403.496=-0.429.04529.04773.05017.06011.06865.07
1514.08021.08466.08804.05613.06523.07236.07828.08319.08742
2.05231.06242.0657.07569.08099.08599.08993.05993.06725.07
3316.07829.08305.04919.056.04931.07064.07563.08012.04923.0
40566.06291.06836.07318.07753.04953.05582.06144.06644.0709
58.07514.04993.05523.06015.06467.06387.07278.05017.05468.0
605043.06252.06642.07013.08742.0984.106.109.08559.08784.1
7072.1145.08305.09595.1062.1146.08012.09322.1039.1132.077
853.09015.1008.1104.07514.0873.09781.1071.07278.08431.094
982.1039.07013.08136.09131.1004.0426.05017.05775.06318
DATA(C(I))=497.601=-0.4998.05548.06117.06516.06391.06777.0
1713.07438.07951.08182.08418.08578.09392.09516.09631.0973
29.1068.1073.1077.1081.1066.1093.11738.162.232.2111.2896.
3.287.3485.3448.4254.4009.4039.4021.4009.4701.4638.4614.
4.5591.5356.5281.6469.6311.6115.9036.7664.7244.1.179.9495.
5.8756.1.509.1.179.1.067.1.874.1.445.1.293.4068.4041.4033.4915.
6.473.468.6458.5713.5812.9176.729.675.1.307.9637.8579.1.77
7.1.269.1.103.2.281.1.625.1.399.2.803.2.013.1.731.414.4063.4052
8.5424.4885.4809.8143.6324.6011.1.247.8785.8945.1.783.1.227
9.1.1012.368.1.647.1.471.2.968.2.108.1.887.3.566.2.587.2.329.4.16
DATA(C(I))=602.710=-.41.4078.4069.4717.454.4476.4468.5563
1.515.4997.4927.6034.6034.5727.5584.8573.7259.6736.6481.
21.074.8845.8056.7664.1.326.1.076.9688.9391.601.1.295.1.159.
31.008.1.893.1.534.1.371.1.284.2.196.1.786.1.6.1.498.2.503.2.052.1.
6641.1.725.2.842.2.473.3.147.2.86.2.699.4254.4189.416.4142.413.4
571.2.602.2.453.3.74.4663.4628.613.5739.5552.5437.5357.7416.71
6979.4737.4734.4663.4628.613.5739.5552.5437.5357.7416.71
735.6798.6585.6434.1.001.9009.8493.8158.7916.1.262.1.13.1.06
8.1.013.9794.1.553.1.391.1.304.1.245.1.281.1.863.1.675.1.571.1.581
9.1.448.2.186.1.974.1.856.1.775.1.714.2.516.2.282.2.151.2.06.1.992
DATA(C(I))=711.735=-2.849.2.596.2.453.2.353.2.278.3.182.2.911.2.
1757.2.65.2.569.3.513.3.226.3.062.2.948.2.86.3.841.3.539.3.366.3.24
25.3.153.4.165.3.449.3.668.3.541.3.443
END

```

FUNCTION EHVISC(PRES,ENTH)

COMMON/EMHU/V(1820)

```

DIMENSION LOC(24),JP(24),DP(24),OH(24),BP(24),BH(24),MX(24),
1PL(19),HL(19),HG(19),VL(19),VG(19),HS(11)
DATA(LOC=1,19,29,757,39,63,93,111,165,210,235,285,325,345,400,
1425,485,525,621,661,773,791,428,530)
DATA(JP=3,3,3,4,4,5,3,9,5,5,5,5,5,5,5,8,8,3,5,5,8)
DATA(HX=1,1,2,2,3,1,7,3,3,3,3,3,3,3,3,6,6,6,1,3,0,1)
DATA(BP=0,-1,0,0,1000,-0,1000,4000,-4000,3000,3000,-1000,,
12000,2000,1000,1000,-50,-50,-50,-10,1,1,1000,0,0)
DATA(OP=1500,1500,3,1000,1000,1000,500,500,250,250,,
1250,-250,-500,-250,-250,-250,-150,-150,150,150,20,1,250,,
2 250,,)

```

FUNCTION EHVISC(PRES,ENTH)

```

DIMENSION LOC(24),JP(24),DP(24),OH(24),BP(24),BH(24),MX(24),
1PL(19),HL(19),HG(19),VL(19),VG(19),HS(11),V(1820)
DIMENSION AA( 67),AB( 66),AC( 72),AD( 72),AE( 66),AF( 72),AG( 68)
1 ,AH( 68),AI( 70),AJ( 70),AK( 66),AL( 63)
EQUIVALENCE( V,AA),( V,AB),( V, 68),AB),( V( 134),AC),( V( 206),AD)
1 , ( V( 278),AE),( V( 344),AF),( V( 416),AG),( V( 484),AH)
2 , ( V( 552),AI),( V( 622),AJ),( V( 692),AK),( V( 758),AL)
DATA(AA=1.567E-10,1.498E-10,1.419E-10,1.86E-10,1.758E-10,1.663E-10,
12.093E-10,1.199E-10,1.861E-10,2.264E-10,2.193E-10,2.075E-10,2.394E-
210,2.367E-10,2.245E-10,2.499E-10,2.517E-10,2.393E-10,1.355E-10,1.2
381E-10,1.210E-10,1.475E-10,1.392E-10,1.321E-10,1.587E-10,1.496E-10
4,1.419E-10,0.,1.355E-10,1.355E-10,1.355E-10,1.475E-10,1.475E-10,1.

```





```

82 491E-10,0,1,306E-10,1,517E-10,1,810E-10,2,234E-10,2,617E-10,1,2
934E-10,1,413E-10,1,655E-10,2,013E-10,2,515E-10,1,173E-10
DATA(V(1),1,274,335)1,329E-10,1,611E-10,2,51E-10,1,122
1E-10,1,239E-10,1,431E-10,1,66E-10,1,99E-10,1,077E-10,1,2E-10,1,35E
2-10,1,542E-10,1,804E-10,1,038E-10,1,149E-10,1,282E-10,1,447E-10,1,
363E-10,9,717E-11,1,066E-10,1,175E-10,1,304E-10,1,462E-10,9,177E-1
4,1,1E-10,1,093E-10,1,2E-10,1,324E-10,8,723E-11,3,465E-11,1,828E-10
5,1,119E-10,1,23E-10,8,334E-11,9,009E-11,9,742E-11,1,854E-11,1,144
6E-10,7,994E-11,8,617E-11,9,206E-11,1,001E-11,1,001E-11,7,694E-11,8,
724E-11,8,891E-11,9,551E-11,1,026E-10,7,425E-11,7,97E-11,8,545E-11,
8,9,156E-11,9,807E-11,4,464E-11,5,592E-11,6,779E-11,8,110E-11,9,717
9E-11,4,135E-11,5,183E-11,6,240E-11,7,406E-11,8,723E-11,3,859E-11)
P=PRES
IF(P,LT,1.0) P=1.0
M=EMTH
IF(M,LT,100.0) GO TO 9
IF(M,LT,425.0) GO TO 5
IF(M,LT,700.0) GO TO 3
IF(M,LT,1000.0) GO TO 34
IF(M,GE,25000.0)M=24999.9999
N=1
GO TO 33
1 IF(P,LT,5.0) GO TO 2
GO TO 33
2 M=22
GO TO 33
3 IF(M,LT,1000.0) GO TO 4
M=4
GO TO 33
4 M=5
GO TO 33
34 IF(P,LT,5.0)GO TO 35
GO TO 33
35 M=3
GO TO 33
5 IF(M,LT,200.0) GO TO 7
IF(P,LT,1000.0) GO TO 6
M=6
GO TO 33
6 M=7
IF(M,LT,290.0)M=24999.9999
GO TO 33
7 IF(P,LT,1000.0) GO TO 8
M=8
GO TO 33
8 M=20
GO TO 33
9 IF(P,LT,3000.0) GO TO 13
IF(P,LT,4000.0) GO TO 11
IF(M,GE,60.0) GO TO 10
M=9
GO TO 30
10 M=10
GO TO 33
11 IF(M,GE,30.0) GO TO 12

```

```

3533E-10,2,093E-10,2,771E-10,0,1,048E-10,1,335E-10,1,839E-10,2,433
4E-10,0,9,65E-11,1,195E-10,1,558E-10,2,095E-10,2,726E-10,8,986E-11
5,1,089E-10,1,368E-10,1,843E-10,2,407E-10,8,439E-11,1,006E-10,1,231
6E-10,1,579E-10,2,092E-10,7,979E-11,9,397E-11,1,127E-10,1,307E-10,1
7,844E-10,7,585E-11,8,849E-11,1,045E-10,1,264E-10,1,596E-10,7,243E-
8,1,8,387E-11,9,788E-11,1,62E-10,1,1423E-10,6,942E-11,7,99E-11,9,23
9E-11,1,081E-10,1,294E-10,6,674E-11,7,645E-11,8,776E-11,1,016E-10,
DATAAM/1,195E-10,6,433E-11,7,341E-11,8,377E-11,9,966E-11,5,665E-11,6,405
1,6,016E-11,6,827E-11,7,722E-11,8,767E-11,9,966E-11,5,665E-11,6,405
2E-11,7,202E-11,8,088E-11,9,102E-11,5,362E-11,6,049E-11,6,775E-11,7
3,562E-11,8,44E-11,5,098E-11,5,744E-11,6,414E-11,7,13E-11,7,909E-11
4,4,863E-11,5,476E-11,6,104E-11,6,763E-11,7,41E-11,8,653E-11,5,24C
5-11,5,833E-11,6,448E-11,7,099E-11,8,464E-11,5,028E-11,5,592E-11,6,
6172E-11,6,779E-11,1,153E-10,1,603E-10,2,096E-10,0,1,16E-11,1,5
734E-11,2,039E-11,1,005E-10,1,297E-10,1,673E-10,2,099E-10,0,1,306E
8-11,1,602E-11,1,908E-11,8,4E-11,1,094E-10,1,381E-10,1,743E-10,2,22
95E-10,1,439E-11,1,687E-11,1,99E-11,7,88E-11,9,586E-11,1,162E-10,
DATAAL/1,467E-10,1,89E-10,2,337E-10,0,0,7,15E-11,8,55E-11,1,014E
1-10,1,23E-10,1,553E-10,1,958E-10,2,355E-10,0,6,56E-11,7,776E-11,9
2,059E-11,1,071E-10,1,298E-10,1,64E-10,2,0E-10,0,6,06E-11,7,158E-11
3,8,24E-11,9,564E-11,1,128E-10,1,366E-10,1,709E-10,2,186E-10,5,63E-
4,1,6,649E-11,7,589E-11,8,696E-11,1,006E-10,1,189E-10,1,439E-10,1,7
554E-10,5,25E-11,6,217E-11,7,057E-11,8,012E-11,9,148E-11,1,056E-10,
61,242E-10,1,504E-10,4,91E-11,5,843E-11,6,61E-11,7,455E-11,8,428E-1
7,1,9,595E-11,1,106E-10,1,299E-10,4,4E-11,5,514E-11,6,226E-11,6,99E-
8,1,7,846E-11,8,84E-11,1,004E-10,1,155E-10,4,32E-11,5,22E-11,5,89E-
9,1,6,593E-11,7,361E-11,8,23E-11,9,247E-11,1,048E-10,4,05E-11,
DATAA/4,953E-11,5,593E-11,6,249E-11,6,95E-11,7,725E-11,8,61E-11,9
1,65E-11,3,6E-11,4,48E-11,5,084E-11,5,675E-11,6,283E-11,6,931E-11,7
2,841E-11,8,439E-11,3,0E-11,4,053E-11,4,658E-11,5,209E-11,5,758E-11,
36,326E-11,6,93E-11,7,585E-11,0,3,715E-11,4,280E-11,4,81E-11,5,32
40E-11,5,843E-11,6,377E-11,6,942E-11,0,3,374E-11,3,959E-11,4,49E-
5,1,4,965E-11,5,444E-11,5,929E-11,6,433E-11,0,3,047E-11,3,66E-11,4
6,181E-11,4,651E-11,5,104E-11,5,556E-11,6,016E-11,0,2,1E-11,3,128E
7-11,3,672E-11,4,129E-11,4,551E-11,4,958E-11,5,362E-11,0,1,652E-11
8,2,666E-11,3,25E-11,3,707E-11,4,112E-11,4,493E-11,4,863E-11,0,1,3
956E-11,2,267E-11,2,896E-11,3,356E-11,3,752E-11,4,117E-11,
DATAAK/4,464E-11,6,7E-13,1,111E-11,2,6E-11,2,606E-11,3,064E-11,3,45
13E-11,3,804E-11,4,35E-11,3,68E-12,9,3-12,1,79E-11,2,77E-11,2,8
224E-11,3,203E-11,3,542E-11,3,859E-11,5,36E-12,1,06E-11,1,644E-11,2
3,202E-11,2,629E-11,2,994E-11,3,321E-11,1,625E-11,6,87E-12,1,089E-1
4,1,557E-11,2,07E-11,2,475E-11,2,822E-11,3,136E-11,3,427E-11,8,1E
5-12,1,139E-11,1,516E-11,1,972E-11,2,355E-11,2,683E-11,2,981E-11,3,
6250E-11,9,16E-12,1,192E-11,1,506E-11,1,902E-11,2,262E-11,2,571E-11
7,6,893E-11,3,16E-11,1,006E-11,1,246E-11,1,515E-11,1,3E-11,1,534E-11,1,8
929E-11,2,139E-11,2,414E-11,2,663E-11,2,898E-11,5,138E-11,
DATAAL/5,164E-11,5,193E-11,5,229E-11,8,443E-11,8,207E-11,8,5-11,7,
1819E-11,1,117E-10,1,078E-10,1,044E-10,1,013E-10,1,355E-10,1,304E-1
20,1,259E-10,1,218E-10,1,587E-10,1,587E-10,1,586E-10,1,853E-10,1,86
3E-10,1,863E-10,2,036E-10,2,077E-10,2,091E-10,2,14E-10,2,231E-10,2
4,263E-10,2,2E-10,2,347E-10,2,393E-10,2,20E-10,2,439E-10,2,499E-10,2
5,587E-10,1,587E-10,1,587E-10,1,587E-10,1,587E-10,1,587E-10,1,651E-10,1,855E
6-10,1,857E-10,1,859E-10,1,86E-10,2,03E-10,2,047E-10,2,055E-10,2,06
71E-10,2,066E-10,2,148E-10,2,175E-10,2,19E-10,2,201E-10,2,208E-10,2
8,235E-10,2,27E-10,2,29E-10,2,304E-10,2,314E-10,2,305E-10,2,346E-10
9,2,369E-10,2,386E-10,2,399E-10/
DATA LOC/1,19,29,757,39,63,93,111,165,210,235,285,325,345,400,

```



164

```

EHVISC=((VVG(I)*OB+VG(I-1)*OF)/D-VLIQ)*(H-HLIQ)/(MGAS-HLIQ)+VLIQ
RETURN
30 PR=P/500.0
I=PR
IF(I.GT.9) I=9
F=PR-I
MSOL=F*MS(I+2)*(1.0-F)*MS(I+1)
IF(M.LI.HSOL) M=MSOL
33 FP=(P-BP(N))/DP(N)
IP=FP
IF(IP.GT.MX(N)) IP=MX(N)
F=FP-IP
FP=1.0-F
FM=(H-BH(N))/DH(N)
IM=FM
FF=FM-IM
FM=1.0-FF
I=IM*JP(N)+IP*LOC(N)
J=I*JP(N)
EHVISC=FP*FM*V(I)+F*FM*V(I+1)+FP*FF*V(J)+F*FF*V(J+1)
RETURN
END

```

```

FUNCTION EHSOUN (PRES,ENTH)
DIMENSION LOC(15),JP(15),MX(15),BP(15),DP(15),BH(15),DH(15)
1,R(15),HL(19),HV(19),VL(19),VG(19),MS(10),V(326)
DIMENSION AA(103),AB(106),AC(112),AD( 3)
EQUIVALENCE ( V,AA), ( V( 104),AB), ( V( 212),AC), ( V( 324),AD)
DATA LOC/1,2,3,4,4,1,7,7,9,11,2,14,0,14,3,246,189,221,246,282/
DATA JP/5,5,5,5,3,7,7,4,7,7,9,4,5,9,9/
DATA MX/0,0,0,0,0,5,5,2,2,2,1,5,3,7,7/
DATA BP/1,10,100,1000,1000,3000,0,1000,2000,5,500,1000,
1 400,80,0,0,0/
DATA DP/9,90,900,4000,4000,500,1000,1000,165,500,500,
1 200,80,50,50,0/
DATA BH/500,5000,5000,5000,600,400,400,50,100,100,
1 -100,-110,-140,0,20,0/
DATA DH/3000,3000,3000,3000,400,50,50,50,50,30,
1 35,5,20,0/
DATA R/1,022,2,0,4,0,8,0,14,0,25,0,43,0,69,0,99,0,128,0,151,0,
1165,0,176,0,182,0,185,0,186,5,187,25,187,468,75,187,510,12/
DATA HV/60,35,65,19,70,69,76,60,81,50,86,38,69,93,91,24,89,18,83,9
10, 76,55,69,46,61,16,53,87,47,96,43,01,38,21,34,66,31,225/
DATA HL/-132,80,-129,10,-124,16,-117,53,-110,29,-100,02,-86,44,-69
1 51,29,-33,56,-18,32,-7,62,7,73,10,26,15,84,20,35,24,71,28,00,
231,225/
DATA HS =-132.81,-109.93,-87.52,-65.56,-44,-22.76,-1.79,18.98,
1 39.60,60.07/
DATA VL= 4161.,4041.,3879.,3706.,3536.,3290.,2968.,2577.,2176.,
1 1821.,1550.,1376.,1176.,1059.,994.,959.,939.,932.,931.5/
DATA VG= 1002.,1040.,1080.,1116.,1140.,1155.,1152.,1130.,1094.,
1 1053.,1013.,992.,976.,968.,959.,951.,942.,936.,931.5/

```

```

1.666E-11,3.25E-11,3.707E-11,4.112E-11,4.493E-11,4.863E-11,0.,1.356
2E-11,2.287E-11,2.896E-11,3.356E-11,3.752E-11,4.117E-11,4.464E-11,6
3.7E-13,1.11E-11,6.606E-11,3.066E-11,3.453E-11,3.804E-11,4.
413E-11,3.88E-12,9.79E-12,1.79E-11,2.377E-11,2.84E-11,3.203E-11,3
5.542E-11,3.859E-11,5.36E-12,1.05E-11,1.644E-11,2.202E-11,2.629E-11
6.2.994E-11,3.321E-11,3.625E-11,6.07E-12,1.089E-11,1.557E-11,2.07E-
711,2.475E-11,2.822E-11,3.136E-11,3.427E-11,6.11E-12,1.139E-11,1.51
86E-11,1.972E-11,2.355E-11,2.683E-11,2.981E-11,3.258E-11,3.46E-12,1
9.192E-11,1.508E-11,1.902E-11,2.262E-11,2.571E-11,2.853E-11
DATA(V(1),I=740,803)=3.116E-11,1.006E-11,1.246E-11,1.515E-11,1.85
16E-11,2.192E-11,2.482E-11,2.748E-11,2.997E-11,1.087E-11,1.3E-11,1.
2534E-11,1.629E-11,2.139E-11,2.414E-11,2.663E-11,2.898E-11,5.138E-1
31.5,164E-11,5.193E-11,5.229E-11,8.443E-11,8.207E-11,8.207E-11,7.818E-
411,1.17E-10,1.076E-10,1.046E-10,1.013E-10,1.355E-10,1.304E-10,1.2
599E-10,2.18E-10,1.587E-10,1.587E-10,1.586E-10,1.853E-10,1.862E-10
6.1.063E-10,2.036E-10,2.077E-10,2.091E-10,2.140E-10,2.231E-10,2.263
7E-10,2.2E-10,2.347E-10,2.393E-10,2.280E-10,2.439E-10,2.499E-10,2.5
807E-10,1.587E-10,1.587E-10,1.587E-10,1.587E-10,1.851E-10,1.855E-10
9.1.857E-10,1.859E-10,1.859E-10,2.03E-10,2.047E-10,2.055E-10
DATA(V(1),I=804,820)=2.206E-10,2.866E-10,2.48E-10,2.175E-10,2.19
1E-10,2.201E-10,2.202E-10,2.235E-10,2.27E-10,2.29E-10,2.304E-10,2.3
214E-10,2.305E-10,2.346E-10,2.369E-10,2.386E-10,2.399E-10
END

```

```

FUNCTION EHSOUN (PRES,ENTH)
DIMENSION LOC(15),JP(15),MX(15),BP(15),DP(15),BH(15),DH(15)
1,R(19),HL(19),HV(19),VL(19),VG(19),MS(10)
COMMON /ENHVEL/ V(326)
DATA(LOC=1,2,3,4,4,1,7,7,9,11,2,14,0,14,3,246,189,221,246,282)
DATA(JP=5,5,5,5,3,7,7,4,7,7,9,4,5,9,9)
DATA(MX=0,0,0,0,0,5,5,2,2,2,1,5,3,7,7)
DATA(BP=1,10,100,1000,1000,3000,0,1000,2000,5,500,1000,
1 400,80,0,0,0)
DATA(DP=9,90,900,4000,4000,500,1000,1000,165,500,500,
1 200,80,50,50,0)
DATA(BH=500,5000,5000,5000,600,400,400,50,100,100,
1 -100,-110,-140,0,20,0)
DATA(DH=3000,3000,3000,3000,400,50,50,50,50,30,
1 35,5,20,0)
DATA R=1.022,2,0,4,0,8,0,14,0,25,0,43,0,69,0,99,0,128,0,151,0,
1165,0,176,0,182,0,185,0,186,5,187,25,187,468,75,187,510,12)
2 (HV=60,35,65,19,70,69,76,60,81,50,86,38,69,93,91,24,89,18,83,90,
3 76,55,69,46,61,16,53,87,47,96,43,01,38,21,34,66,31,225)
4 (HL=-132,80,-129,10,-124,16,-117,53,-110,29,-100,02,-86,44,-69,5,
5 -51,29,-33,56,-18,32,-7,62,7,73,10,26,15,84,20,35,24,71,28,00,
6 31,225)
DATA(HS =-132.81,-109.93,-87.52,-65.56,-44,-22.76,-1.79,18.98,
1 39.60,60.07)
DATA(VL= 4161.,4041.,3879.,3706.,3536.,3290.,2968.,2577.,2176.,
1 1821.,1550.,1376.,1176.,1059.,994.,959.,939.,932.,931.5)
DATA(VG= 1002.,1040.,1080.,1116.,1140.,1155.,1152.,1130.,1094.,
1 1053.,1013.,992.,976.,968.,959.,951.,942.,936.,931.5)
DATA(V(1),I=1,10)=7064.,7065.,7074.,7161.,7586.,8767.,8768.,8775

```



```

8 IF(M.LT.100.) GO TO 10
  IF(P.GE.500.) GO TO 9
  N=9
  GO TO 33
9 N=10
  GO TO 33
10 IF(P.LT.400.) GO TO 12
  IF(P.LT.1000.) GO TO 11
  N=11
  GO TO 30
11 N=12
  GO TO 30
12 IF(M.GE.0.) GO TO 13
  N=13
  IF(M.LT.-132.7285+P*.08224) GO TO 30
  GO TO 20
13 IF(M.GE.20.) GO TO 14
  N=14
  GO TO 20
14 N=15
  GO TO 20
20 IF(P.GT.187.51012) GO TO 33
  DO 21 I=2,19
  IF(P-R(I))22,22,21
21 CONTINUE
22 F=(P-R(I-1))/(R(I)-R(I-1))
  CHL=HL(I-1)+(HL(I)-HL(I-1))*F
  CHV=HV(I-1)+(HV(I)-HV(I-1))*F
  IF(M.LT.-CHL-OR-M.GT.CMV) GO TO 33
  SVL=VL(I-1)+(VL(I)-VL(I-1))*F
  SVG=VG(I-1)+(VG(I)-VG(I-1))*F
  F=(M-CHL)/(CMV-CHL)
  ENSOUN=SVL+(SVG-SVL)*F
  RETURN
30 PR=P/587.84
  I=PR
  IF(I.GT.8) I=8
  F=PR-I
  FP=1.-F
  G=FP*MS(I+1)+F*MS(I+2)
  IF(M.LT.G)M=G
33 FP=(P-BP(N))/DP(N)
  IP=FP
  IF(IP.GT.MX(N)) IP=MX(N)
  F=FP-IP
  FP=1.-F
  FM=(M-BH(N))/DH(N)
  IM=FM
  FF=FM-IM
  FH=1.-FF
  I=IM*JP(N)+IP*LOC(N)
  J=I+JP(N)
  ENSOUN=FP*FM*V(I)+F*FM*V(I+1)+F*FF*V(J)+F*FF*V(J+1)
  RETURN
END

```

```

FUNCTION EHCIP(PRES,ENTH)
EHCIP=EHHEAT(PRES,ENTH,1)
RETURN
END
FUNCTION EHCIP(PRES,ENTH)
EHCIP=EHHEAT(PRES,ENTH,2)
RETURN
END
FUNCTION EHCIP(PRES,ENTH)
EHCIP=EHHEAT(PRES,ENTH,3)
RETURN
END
FUNCTION EHCIP(PRES,ENTH,KTRANS)
COMMON/EPHEAT/CP(749),CV(749)
DIMENSION LOC(22),JP(18),MX(18),BP(18),DP(18),BM(23),DH(18),R(19),
1ML(19),MV(19),MS(10),CVL(19),CVV(19)
DATA CVV/1.490,1.505,1.538,1.601,1.686,1.826,2.024,2.274,2.537,
1 2.786,2.988,3.186,3.304,3.404,3.483,3.536,3.566,3.568,3.562/
DATA CVL/1.133,1.190,1.273,1.384,1.501,1.662,1.865,2.099,2.329,
1 2.524,2.675,2.776,2.898,3.086,3.245,3.371,3.475,3.535,3.562/
DATA R/1.022,2.0,4.0,8.0,14.0,25.0,43.0,69.0,99.0,128.0,151.0,
1165.0,176.0,182.0,185.0,186.5,187.25,187.46875,187.51012/
DATA MV/60.35,65.19,70.69,76.60,81.50,86.38,89.99,91.24,89.18,83.9
10.76,55.69,46.61,16.53,8.74,7.96,43.01,38.21,34.66,31.225/
DATA ML/-132.80,-129.10,-124.16,-117.53,-110.29,-100.02,-86.44,-69.
15,-51.29,-33.56,-18.32,-7.62,2.73,10.26,15.84,20.35,24.71,28.00,
2 31.225/
DATA MS /-132.81,-109.93,-87.52,-65.56,-44.-22.76,-1.79,18.98,
1 39.60,60.07/
DATA LOC/1.21,63.84,133.14,156.160,257.237,273.318,360.409,444,
1 528.563,626.671,686,710,722/
DATA JP/5.6,3.7,2.3,9.9,4.4,5.3,7.7,7.9,9/
DATA MX/3.4,1.5,0.1,3.3,2.2,3.1,5.5,5.7,0/
DATA BP/1000.0,20.0,15.0,0.0,1000.0,2000.0,2000.0,2000.0,2000.0,2000.0,
10.300,0.0,140.0,0.0/
DATA DP/1000.0,2000.0,40.5,4985.2500,2500.0,2500.0,1000.0,1000.0,2500.0,
1200.0,100.0,100.0,50.0,20.0,150.0/
DATA BM/9200.0,9200.0,9200.0,9200.0,2600.0,2600.0,1000.0,200.0,200.0,2000.0,20000.0,
1 120.0,-125.0,-135.0,120.0,-45.60,-50.2000,20000.0,20000.0,20000.0,
2 20000.0/
DATA DH/3600.0,1800.0,1800.0,1800.0,2200.0,400.0,100.0,100.0,40.0,25.0,40.0,
125.0,15.0,20.0,15.0,15.0,10.0,50.0/
DATA VERYBG/1.0E+38/
KTR=KTRANS
1 P=PRES
IF(P.LT.1.0) P=1.0
IF(P.LT.200.0) GO TO 9
IF(M.LT.9200.0) GO TO 5
IF(M.GE.25000.0) M=24999.99999
IF(P.LT.100.0) GO TO 3
IF(P.LT.1000.0) GO TO 2
N=1
N1=19
GO TO 33
2 N=2

```

```

6.2.167.2.017.1.052.1.60.2.907.2.047.2.764.2.663.2.541.3.279.3.266,
73.236.3.191.3.131.3.453.3.501.3.499.3.486.3.468.3.597.3.608.3.616,
93.622.3.622.3.622.3.627.3.636.3.647.3.659.3.569.3.583.3.586.3.597,
93.611.926.886.797.1.354.1.239.1.111.1.821.1.707.1.587.2.269)
DATA(VERYBIG=3777777777777777)
KTR=1
GO TO 1
ENTRY ENCV
KTR=2
GO TO 1
ENTRY ENGAMM
KTR=3
1 P=PRES
IF(P.LT.1.0) P=1.0
M=ENTH
IF(M.LT.200.) GO TO 9
IF(M.LT.9200.) GO TO 5
IF(M.GE.25000.) M=24999.99993
IF(P.LT.100.) GO TO 3
IF(P.LT.1000.) GO TO 2
N=1
N1=19
GO TO 33
2 N=2
GO TO 33
N1=28
GO TO 33
3 IF(P.LT.30.) GO TO 4
N=3
GO TO 33
4 N=4
N1=22
GO TO 33
5 IF(M.LT.1000.) GO TO 7
IF(M.LT.2600.) GO TO 6
N=5
GO TO 33
6 N=6
GO TO 33
7 IF(P.GE.1000.) GO TO 8
N=7
IF(P.LE.150.) AND.(M.LT.300.) N=18
GO TO 33
8 N=8
GO TO 33
9 IF(P.LT.600.) GO TO 13
IF(P.LT.2000.) GO TO 11
IF(M.LT.80.) GO TO 10
N=9
GO TO 33
10 N=10
GO TO 30
11 IF(P.LT.1000.) GO TO 12
N=11
GO TO 30
12 N=12
GO TO 30
13 IF(M.GE.-45.) GO TO 14
N=13
IF(M.LT.-132.7285+P*0.08224) GO TO 30
GO TO 20
14 IF(M.LT.120.) GO TO 15
N=14
GO TO 33
15 IF(P.LT.300.) GO TO 16
N=15
GO TO 33
16 IF(M.LT.60.) GO TO 17
N=16
GO TO 20
17 N=17
20 IF(P.GT.187.51012) GO TO 33
DO 21 I=2,19
IF(P-R(I))22,22,21
21 CONTINUE
22 F=(P-R(I-1))/(R(I)-R(I-1))
CHV=HL(I-1)+(HL(I)-HL(I-1))*F
CHV=MV(I-1)+(MV(I)-MV(I-1))*F
IF(M.LT.-CHL.OR.M.GT.-CHV) GO TO 33
IF(KTR.EQ.2) GO TO 23
EMCP=VERYBIG
EMHEAT=EMCP

```



```

M=13
IF(M.LT.-132.7285+P*0.08224) GO TO 38
GO TO 20
14 IF(M.LT.-128.) GO TO 15
M=14
GO TO 33
15 IF(P.LT.300.) GO TO 16
M=15
GO TO 33
16 IF(M.LT.88.) GO TO 17
M=16
GO TO 20
17 M=17
20 IF(P.GT.187.51012) GO TO 33
DO 21 I=2,19
IF(P-R(I))22,22,21
21 CONTINUE
22 F=(P-R(I-1))/(R(I)-R(I-1))
CML=ML(I-1)*ML(I)-ML(I-1)*F
CHV=HV(I-1)*HV(I)-HV(I-1)*F
IF(M.LT.CHL.OR.M.GT.CNV) GO TO 33
IF(KTR.EQ.2) GO TO 23
EMCP=VERYBIG
RETURN
23 CL=CVL(I-1)*CVL(I)-CVL(I-1)*F
CG=CVV(I-1)*CVV(I)-CVV(I-1)*F
EMCP=CL+(CG-CL)*(M-CHL)/(CHV-CHL)
RETURN
38 F=P/567.84
IF(I.GT.8) I=8
F=F-I
V=(1.0-F)*HS(I+1)+F*HS(I+2)
IF(M.LT.V) M=V
33 IF(M.LE.20000.)M1=M
FP=(P-BP(N))/DP(N)
IP=FP
IF(IP.GT.MX(N)) IP=MX(N)
F=FP-IP
FP=1.-F
FH=(M-BH(N1))/DH(N)
IM=FM
FF=FM-IM
FM=1.-FF
I=IM*JP(N)+IP*LOC(N1)
J=I+JP(N)
IF(KTR.EQ.2) GO TO 35
MCP=FP*FM*CV(I)+F*FM*CP(I+1)+FP*FF*CP(J)+F*FF*CP(J+1)
IF(M.LT.13) GO TO 34
IF(M.EQ.18) GO TO 34
S=M*500.
MCP=MCP/(3375.79281335/S-14.6519689802+0.0177028811778*S-6.9405665
1 3567E-9*S*S)
34 IF(KTR.GE.2) GO TO 35
EMHEAT=MCP
RETURN
35 EMCP=FP*FM*CV(I)+F*FM*CV(I+1)+FP*FF*CV(J)+F*FF*CV(J+1)
EMHEAT=EMCP
IF(KTR.LT.3) RETURN
EMCP=MCP/EMCP
EMHEAT=EMCP
RETURN
END

BLOCK DATA
COMMON/EPHEAT/AA(111),AB(111),AC(111),AD(111),AE(111),AF(111),
1AG(111), AH(111), AI(111), AJ(111), AK(111), AL(111), AM(111), AN( 75)
1,4,5,4.421,3.798,3.795,3.793,3.791,3.789,4.071,4.061,4.055,4.051,4.048
2,3,799,3.799,3.798,3.796,3.794,3.792,3.790,3.938,3.936,3.935,3.934,4.157
3,4,106,4.088,4.084,4.074,4.071,4.061,4.051,4.041,4.033,4.274,4.256,4.244,
45,22,4.806,4.649,4.576,4.531,4.5,6.217,5.467,5.171,5.029,4.941,4.8
579,7.459,6.334,5.872,5.644,5.499,5.337,3.802,3.801,3.801,3.961,3.9
651,3.946,4.216,4.156,4.132,4.733,4.537,4.454,5.634,5.205,5.013,6.8
789,6.175,5.842,8.381,7.379,6.896,3.814,3.805,3.804,3.803,3.803,3.8
802,3.802,4.097,3.998,3.978,3.973,3.965,3.961,3.959,4.895,4.411,4.30
99,4.263,4.235,4.215,4.201,6.538,5.31,5.018,4.878,4.791,4.73,4.684,
DATAAB/8.635,6.755,6.206,5.929,5.752,5.624,5.527,1.45,8.579,7.77,
17.348,7.07,6.868,6.61,14.19,10.619,555,8.996,8.623,8.347,8.13,3.46
2,3.511,3.504,3.503,3.631,3.621,3.803,3.789,3.165,3.52,3.605,3.32,3

```



```

654.11.06,1.126,1.079,28.349,553.733,904.1016,1.046,34.3,51,
9.577,15.552,965.1027,1.307,971.941,915.892,871.853,
DATA(CP(1),1.570,666)=836,821,1024,966,923,886,856,83,80
17.787,77,1.117,1.003,928,879,835,799,77,746,725,133,111
251.104,902,833,781,749,717,691,981,604,1.222,1.012,866
3.803,74,705,67,0.3,11,1.984,1.308,1.029,876,781,715,673,
40.6,92,3.92,1.976,1.329,1.028,668,767,698,161,5,14,12,3,1
51.1,798,1.245,933,848,75,44,57.5,003,1.22,6,54,2,531,11,567,1,
717,98,828,4,493,810,29,72,66,662,967,1.84,1.356,1.091,928,
60.10,15,6,526,4,526,2,673,1.887,1.453,1.193,1.019,0,4,519,3,724,
82,706,2,099,1,71,1.432,1.23,1.08,5,39,5,124,4,994,4,912,4,856,6,7
982,6,24,3,5,976,5,802,5,679,4,369,7,575,7,158,6,886,6,689,7,459,
DATA(CP(1),1.687,749)=37,5,87,5,644,5,499,5,397,6,85,7,352,6,
171,6,395,6,189,0,10,32,8,469,7,665,7,249,6,978,6,782,11,83,9,6
235,8,669,8,165,7,833,7,591,8,381,7,379,6,896,10,8,729,8,101,11,69
3,10,16,9,394,13,39,11,63,10,73,14,19,10,6,9,555,8,996,8,623,8,347,
40,13,16,96,12,72,11,45,10,76,10,3,9,957,9,685,19,72,14,86,13,38,12
5,58,12,04,11,63,11,31,22,4,16,99,15,32,14,1,13,75,13,32,12,95)
END

```

# SUBROUTINE E C SUB V COMMON/EPHEAT/ CP(749),CV(749)

```

DATA(CV(1),1.328,437)=2,19,2,091,2,641,2,601,2,539,2,932,2,923,2,
1893,3,153,3,165,3,159,3,16,3,338,3,363,4,39,3,461,3,474,3,529,3,
2545,3,556,3,588,3,597,3,605,3,622,3,623,3,624,3,632,3,624,3,624,3,617,3,
3622,3,603,3,589,1,1,1,045,997,96,931,0,0,1,337,1,289,1,2,4,1,
4182,1,128,1,072,1,012,1,588,1,545,1,491,1,436,1,38,1,324,1,268,1,8
525,1,75,1,749,1,701,1,649,1,594,1,536,2,032,2,017,1,932,1,959,1,91
68,1,872,2,821,2,196,2,222,2,24,2,197,2,171,2,37,2,072,2,43,6,37,
724,1,408,2,397,2,37,2,35,2,032,2,749,3,215,3,435,3,533,3,567,3,5
878,2,369,2,916,3,272,3,471,3,566,3,601,3,612,2,689,3,093,3,359,3,51
9,3,591,3,622,3,629,2,959,3,251,3,44,3,547,3,608,3,629,3,632,3,172,
DATA(CV(1),1.438,546)=3,376,3,505,3,576,3,615,3,625,3,622,2,408,2
1,403,2,397,2,348,2,377,2,364,2,35,2,592,2,595,2,595,2,592,2,588,2
2582,2,573,2,75,2,76,2,766,2,769,2,77,2,77,2,767,2,687,2,901,2,912,
32,92,2,926,2,932,2,932,3,007,3,023,3,038,3,05,3,059,3,067,3,072,3,1
423,3,133,3,143,3,162,3,173,3,182,3,189,3,231,3,232,3,245,3,259,3,2
569,3,279,3,288,3,296,3,316,3,33,3,343,3,352,3,362,3,37,3,362,3,383
6,3,402,3,414,3,423,3,432,3,439,3,392,3,434,3,459,3,473,3,482,3,49,
73,496,3,413,3,489,3,5,3,52,3,531,3,538,3,543,3,435,3,496,3,533,3,5
85,3,567,3,575,3,578,4,467,1,836,0,3,238,3,386,3,341,3,296,1,511,
92,031,2,575,3,055,3,28,3,33,3,362,1,612,2,098,2,543,2,934,3,23,
DATA(CV(1),1.547,656)=3,318,3,392,1,79,2,212,2,619,2,97,3,177,3,3
121,3,413,2,023,2,393,2,737,3,012,3,203,3,34,3,435,2,367,2,348,2,34
28,2,364,2,347,2,346,2,345,2,343,2,341,2,462,4,466,2,469,2,47,
32,472,2,472,2,472,2,472,2,472,2,472,2,472,2,472,2,472,2,472,2,472,2,472,
42,592,2,592,2,592,2,592,2,592,2,592,2,592,2,592,2,592,2,592,2,592,2,592,
56,2,753,2,76,2,767,2,774,2,781,2,787,2,793,2,798,0,2,84,2,843,2,
685,2,859,2,866,2,873,2,882,2,887,0,3,131,3,076,2,99,2,94,2,947,2,
795,2,961,2,964,3,17,3,449,3,444,3,244,3,128,3,068,3,043,3,038,3,0
845,3,469,3,555,3,624,3,459,3,305,3,199,3,139,3,123,3,123,3,505,3,5
902,3,575,3,521,3,412,3,288,3,222,3,205,3,2,0,3,356,3,444,3,475)
DATA(CV(1),1.657,749)=3,429,3,345,3,28,3,264,3,257,0,3,239,3,332
1,3,386,3,386,3,348,3,333,3,3,296,2,299,4,057,3,94,3,867,3,815,5,
2506,5,035,4,04,6,49,4,541,6,074,6,159,5,815,5,581,5,41,6,136,5,134
3,8,722,4,519,4,391,4,299,7,365,6,022,5,462,5,178,4,996,4,865,4,846,6
4,881,6,278,9,914,5,678,5,506,9,873,7,968,7,128,6,591,6,404,6,194,6
5,958,6,065,5,635,6,364,7,238,6,684,9,801,8,461,7,791,11,23,9,695,8

```

41.11.23.9.695.8.92.12.15.8.94.8.005.7.506.7.174.6.928.6.734.14.53.510.76.9.642.9.035.8.323.8.003.16.86.12.58.11.29.10.59.10.11.69.749.9.466.19.12.14.36.12.91.12.12.11.57.11.17.10.85/  
END

```

FUNCTION EHLFAC(PRES,ENTH)
  DIMENSION LOC(19),JP(19),DP(19),DM(19),BP(19),BM(19),MX(19),
  1PL(19),ML(19),HG(19),CL(19),CG(19),MS(11),C(735)
  DIMENSION AA(112),AB(112),AC(117),AD(108),AE(106),AF( 96),AG( 84)
  EQUIVALENCE( C,AA), ( C( 113),AB), ( C( 225),AC), ( C( 342),AD)
  1 ( C( 450),AE), ( C( 556),AF), ( C( 652),AG)
  DATA LOC/1.29,50.86,149.173,191.269,339.375,407.461,493.517,529,
  1 553,577,601,661/
  DATA JP/4.3,4.7,4.3,5.7,6.4,6.4,4.2,3.3,3.4,5/
  DATA DM/2.1,2.5,2.1,4.5,4.2,4.2,2.0,1.1,1.2,3/
  DATA BP/0.0,0.490,0.132,0.305,0.500,0.1000,0.200,0.0,0.20,0.500,0.2000,
  1 0.0,0.0,0.100,0.0,0.1,
  DATA OP/160.250,170.28,65.250,200.500,100.160,300.1000,
  1 500.3000,1500.300,40.10,1.1,
  DATA BMH/135.105,115.45,45.75,95.60,70.145,25,
  1 75.425,1800.11000,11000.11000,11000.11000,
  DATA DMH/5.10,5.15,23.20,10.15,15.40,50.50,275,1840,
  1 2000.2000,2000.1000,
  DATA PL/1.022,2.0,4.0,8.0,14.0,25.0,43.0,69.0,99.0,128.0,151.0,
  1 165.0,176.0,182.0,185.0,186.5,187.25,187.6875,187.51012,
  2 186.0,176.0,182.0,185.0,186.5,187.25,187.6875,187.51012,
  3 76.56,69.46,61.16,53.87,47.96,43.01,38.21,34.66,31.225,
  2 76.56,69.46,61.16,53.87,47.96,43.01,38.21,34.66,31.225,
  4 76.56,69.46,61.16,53.87,47.96,43.01,38.21,34.66,31.225,
  5 -51.29,-33.56,-18.32,-7.62,2.73,10.26,15.84,20.35,24.71,28.00,
  6 31.225/
  DATA MS/-132.81,-113.32,-94.17,-75.35,-56.84,-38.60,-20.58,-2.75,
  1 14.94,32.50,49.96/
  DATA CL/1.5037E+003,1.808E+003,2.132E+003,2.487E+003,2.824E+003,3.
  2 766E+003,3.815E+003,4.421E+003,5.125E+003,6.065E+003,7.602E+003,9.
  2889E+003,1.440E+004,2.364E+004,4.212E+004,8.362E+004,2.295E+005,9.
  3785E+005,1.040E+009/
  DATA CG/2.643E+003,2.644E+003,2.644E+003,2.691E+003,2.781E+003,3.2
  154E+003,3.710E+003,4.404E+003,5.384E+003,6.892E+003,9.249E+003,1.2
  262E+004,2.077E+004,3.815E+004,7.504E+004,1.690E+005,6.642E+005,3.9
  327E+009,6.650E+009/
  DATA AA/1304.862,4.0,0.1778,1270.1002,0.2081,1683.1207,92
  1 1583.1207,9.926,8.2367,1.2031,1616.1202,3.2611,2311.9,1967.0
  2 1574.3,2857.3,2559.17,2253.74,1890.3093,4.2801,6.2501,2.2200,0.4
  3 3084.2,2629.25,2159.5,3521.9,3099.89,2657.6,3923.4,3508.2,3109.61
  4 4307.5,3874.3,3498.72,4705.6,4215.22,3844.03,5160.7,4544.86,4157
  5 77.5763,4872.19,4448.34,4526.2,4105.3,0.1884,93,1454.9,1105.
  63.0,2179.87,1802.4,1366.1105,3.2430,48,2107.78,1722.16,1340.267
  75.98,2363.77,2037.77,1656.9,2909.99,2610.26,2298.63,1950.3,3125.49
  8 2846.59,2547.9,2223.0,3325.69,3063.4,2786.71,2487.94,3513.27,326
  9 93.78,3005.78,2729.85,181.16,153.18,134.1,148.22,168.51,193.89)
  DATA (C(1),I=82,801)-229.57,232.73,208.76,184.28,192.55,203.59,219
  1.86,237.57,159.35,331.85,286.28,267.12,255.67,249.5,245.63,0.718,
  25.582,418.39,340.63,292.34,259.47,0.19059,140.42,779.84,484.39
  3,352.11,277.21,0.55672,6.118,41,1861.61,735.28,427.81,298.97,1310
  43,151568.2,8535.99,1460.3733,46.466,44,342.95,5569.1,5463.83,12

```

6.92,12.15,8.94,8.005,7.506,7.174,6.928,6.734,14.53,10.76,9.642,9.0  
735.8.627.8.323.8.003.16.86.12.58.11.29.10.59.10.11.9.749.9.466.19.  
812.14.36.12.91.12.12.11.57.11.17.10.85/  
END

```

FUNCTION EHLFAC(PRES,ENTH)
  COMMON/EHLFAC/C(735)
  DIMENSION LOC(19),JP(19),DP(19),DM(19),BP(19),BM(19),MX(19),
  1PL(19),ML(19),HG(19),CL(19),CG(19),MS(11),C(735)
  DATA LOC/1.29,50.86,149.173,191.269,339.375,407.461,493.517,529,
  1 553,577,601,661/
  DATA JP/4.3,4.7,4.3,5.7,6.4,6.4,4.2,3.3,3.4,5/
  DATA DM/2.1,2.5,2.1,4.5,4.2,4.2,2.0,1.1,1.2,3/
  DATA BP/0.0,0.490,0.132,0.305,0.500,0.1000,0.200,0.0,0.20,0.500,0.2000,
  1 0.0,0.0,0.100,0.0,0.1,
  DATA OP/160.250,170.28,65.250,200.500,100.160,300.1000,
  1 500.3000,1500.300,40.10,1.1,
  DATA BMH/135.105,115.45,45.75,95.60,70.145,25,
  1 75.425,1800.11000,11000.11000,11000.11000,
  DATA DMH/5.10,5.15,23.20,10.15,15.40,50.50,275,1840,
  1 2000.2000,2000.1000,
  DATA PL/1.022,2.0,4.0,8.0,14.0,25.0,43.0,69.0,99.0,128.0,151.0,
  1 165.0,176.0,182.0,185.0,186.5,187.25,187.6875,187.51012,
  2 186.0,176.0,182.0,185.0,186.5,187.25,187.6875,187.51012,
  3 76.56,69.46,61.16,53.87,47.96,43.01,38.21,34.66,31.225,
  2 76.56,69.46,61.16,53.87,47.96,43.01,38.21,34.66,31.225,
  4 76.56,69.46,61.16,53.87,47.96,43.01,38.21,34.66,31.225,
  5 -51.29,-33.56,-18.32,-7.62,2.73,10.26,15.84,20.35,24.71,28.00,
  6 31.225/
  DATA MS/-132.81,-113.32,-94.17,-75.35,-56.84,-38.60,-20.58,-2.75,
  1 14.94,32.50,49.96/
  DATA CL/1.5037E+003,1.808E+003,2.132E+003,2.487E+003,2.824E+003,3.
  2 766E+003,3.815E+003,4.421E+003,5.125E+003,6.065E+003,7.602E+003,9.
  2889E+003,1.440E+004,2.364E+004,4.212E+004,8.362E+004,2.295E+005,9.
  3785E+005,1.040E+009/
  DATA CG/2.643E+003,2.644E+003,2.644E+003,2.691E+003,2.781E+003,3.2
  154E+003,3.710E+003,4.404E+003,5.384E+003,6.892E+003,9.249E+003,1.2
  262E+004,2.077E+004,3.815E+004,7.504E+004,1.690E+005,6.642E+005,3.9
  327E+009,6.650E+009/
  DATA (C(1),I=82,801)-229.57,232.73,208.76,184.28,192.55,203.59,219
  1.86,237.57,159.35,331.85,286.28,267.12,255.67,249.5,245.63,0.718,
  25.582,418.39,340.63,292.34,259.47,0.19059,140.42,779.84,484.39
  3,352.11,277.21,0.55672,6.118,41,1861.61,735.28,427.81,298.97,1310
  43,151568.2,8535.99,1460.3733,46.466,44,342.95,5569.1,5463.83,12

```

```

583.12,783.04,575.69,61.17,371.11,4336.32,4900.86,462.46,448.91,42
65.83,399.34,379.87,4730.2,4639.23,4539.07,4448.34,5421.8,5271.19,15
7136.99,501.46,6362.83,5880.6,5695.72,5547.44,7611.84,6681.4,6319.
826.606,47.8935,47.7432,9.6902,37.6550,46.9623,2.7987,1.7310,18.69
932.53,3498.72,3136.0,2736.0,4157.77,3846.6,3527.8,4671.06,44.0,26)
DATA(C1),I=181,2661,134,55,5168,,4870.96,4619.12,5684.8,5236.9,
15016.89,6846.5,5571.4,5353.09,1669.46,1200.1,1107.4,0.0,0.0,2249.2
2,1845.2,1375.75,1250.0,0.0,2729.05,2385.9,2016.1,1597.6,1300.0,0.3
3154.4,2852.29,2528.36,2152.6,1767.78,1357.4,3519.3,3253.06,2969.1
45,2658.37,2314.59,1944.01,3843.2,3602.09,3350.17,3081.53,2790.04,2
5469.78,4134.55,3912.91,3688.31,3444.09,3189.79,2915.46,4391.88,419
61.8,3982.99,3765.12,3536.29,3294.19,4619.12,4431.16,4243.61,4051.4
79,3844.23,3626.36,4026.4,4646.78,4472.81,4295.52,4113.27,3921.75,5
8016.89,4844.42,4678.71,4514.11,4346.57,4173.65,5191.99,5023.81,486
96.4,4711.69,4555.67,4396.67,4353.09,5188.4,5036.73,4890.31)
DATA(C1),I=267,3621,674,83,4597.02,1660.03,0.0,0.0,0.0,0.24
194,481555.4,1300.0,0.0,0.0,3142.92,2386.82,1432.1200.0,0.0,0
2,3631.4,3050.67,2294.3,1369.5,1100.0,0.0,4072.3,3560.7,2964.68,2
3208.2,1317.86,0.10,4396.67,3970.63,3469.7,2891.36,2160.18,1520.0
4,4609.7,4316.07,3920.5,3428.26,2837.83,2091.6,1421.6,4940.59,4607
5,4,4247.24,3861.2,3307.2,2802.9,2063.5155.37,4856.27,4538.56,4188
6,7,3813.3350.2765.8,5339.79,5067.16,4785.16,4479.18,4139.93,3775
7,8,3316.5,2556.16,847.358,11905,,8948.67,519.116932.53,2613.6,5868
8.2,8761.6,8567.39,7651.6,7091.29,2807.07,5068.2,7314.9,7936.16,75
952.77,7165.3084.52,4016.89,6545.91,7412.61,7369.94,7161.02)
P=PRES
M=ENTH
R=1.0
IF(P.LT.1.0) P=1.0
IF(M.GE.425.) GO TO 12
IF(P.LT.500.) GO TO 6
IF(P.LT.2000.) GO TO 2
IF(M.LT.75.) GO TO 1
M=12
GO TO 33
1 M=8
GO TO 22
2 IF(M.LT.25.) GO TO 3
M=11
GO TO 33
3 IF(P.GE.1000.) GO TO 5
IF(M.LT.-75.) GO TO 4
M=6
GO TO 33
4 M=3
GO TO 22
5 M=7
GO TO 22
6 IF(M.LT.-45.) GO TO 11
IF(M.GE.70.) GO TO 9
IF(P.LT.300.) GO TO 7
M=5
GO TO 33
7 M=4
RH=31.225
IF(R.LT.0.) R=-R
IF(P.LT.167.51) GO TO 8
R=1.07(3.113669+.211-577*(P-167.51)+.4467232*R-.004707536*R*

```

```

39,425.,399.5,379.9,4730.,4639.,4539.,4448.,5422.,5271.,5139.,5031.
39,6363.,5881.,5966.,5547.,7612.,6681.,6319.,6060.,8935.,7433.,6903.
5,6550.,9023.,7937.,7310.,6933.,3499.,3137.,2737.,4158.,3847.,3528.
6,4714.,4410.,4135.,5168.,4871.,4619.,5605.,5237.,5017.,6047.,5571.
7,5353.,1669.,1200.,1107.,0.0,0.0,2249.,1845.,1376.,1250.,0.0,0.27
830.,2386.,2016.,1598.,1300.0,0.3154.,2852.,2520.,2153.,1768.,1357.
9,3519.,3254.,2969.,2658.,2315.,1944.,3843.,3602.,3350.,3082./
DATAAC/2790.,2470.,4135.,3913.,3644.,3444.,3190.,2915.,4391.,4192.
1,3983.,3765.,3536.,3296.,3619.,4031.,4244.,4051.,3844.,3626.,4826.
2,3647.,4472.,4256.,4113.,3922.,5017.,4844.,4679.,4514.,4387.,4174.
3,3192.,5024.,4866.,4712.,4556.,4397.,5353.,5188.,5037.,4890.,4745.
4,4597.,1860.,830.0,0.0,0.0,0.0,2494.,1555.,1300.,0.0,0.0,314
53.,2287.,1432.,1200.0,0.0,0.0,3631.,3051.,2294.,1370.,1100.,0.0,
64072.,3561.,2965.,2208.,1318.0,0.0,4397.,3971.,3490.,2891.,2160.
71520.0,4690.,4316.,3921.,3428.,2438.,2092.,1422.,4941.,4608.,424
87.,3861.,3387.,2803.,2063.,5155.,4856.,4539.,4189.,3813.,3350.,276
96.,5340.,4507.,4789.,4479.,4140.,13776.,13317.,2556.,8474.,11900./
DATAAC/8949.,7519.,6933.,2614.,5868.,8762.,8567.,7652.,7091.,2807.
1,5068.,7315.,7936.,7553.,7165.,3885.,4817.,6546.,7413.,7370.,7161.
2,3452.,4849.,6189.,6995.,7169.,7104.,3791.,4918.,5970.,6696.,6983.
3,7018.,4007.,5835.,6923.,7018.,4667.,5721.,6471.,6757.,5115.,5776.
4,6288.,6537.,5369.,5793.,6144.,6345.,546.,5744.,5987.,6150.,5441.
5,5637.,5921.,5961.,5353.,5505.,5648.,5764.,5228.,5349.,5465.,5565.
6,6083.,5526.,5268.,5037.,4818.,4597.,6994.,6154.,5896.,5687.,5507.
7,5340.,7199.,6659.,6301.,5087.,5929.,5790.,6820.,6731.,6503.,6313.
8,6162.,6043.,6537.,6621.,6517.,6380.,6256.,6148.,6297.,6412.,6398.
9,6328.,6244.,6162.,6057.,6186.,6417.,6197.,6154.,6102.,5814.,5793.
DATAAC/5944.,5997.,6012.,6003.,5980.,5565.,5695.,5730.,771.,5793.
1,5800.,5340.,4785.,4181.,3333.,5790.,5368.,4986.,4486.,6043.,5706.
2,5390.,5058.,6148.,587.,5637.,5399.,6162.,5934.,5743.,5570.,6102.
3,5930.,5779.,5636.,5980.,5868.,5758.,5647.,5800.,5765.,5696.,5614.
4,5215.,5565.,5750.,5740.,4576.,4783.,5000.,5070.,4704.,4856.,5005.
5,5068.,5073.,5149.,5225.,5264.,5361.,5402.,5446.,5470.,5572.,5595.
6,5615.,5633.,5572.,5678.,6246.,5157.,6694.,6634.,7184.,7527.,7686.
7,7965.,8507.,8459.,8151.,8318.,8480.,8717.,8828.,8987.,9496.,9371.
8,9570.,10970.,10300.,10360.,13240.,11700.,11510.,16210.,13600.,130
940.,119680.,15950.,14970.,23420.,18600.,17250.,8185.,8180.,8206./
DATAAC/9026.,8789.,8754.,10960.,9705.,9454.,14280.,11450.,10750.,1
19030.,14089.,12720.,24500.,17420.,15340.,30300.,21220.,18440.,3617
20.,25250.,21810.,8228.,8196.,8182.,9553.,8926.,8802.,11960.,10590.
3,10130.,16100.,13520.,12490.,21530.,17610.,15900.,27290.,22520.,20
4150.,33340.,27750.,24790.,39540.,33020.,29540.,8361.,8257.,8220.,8
5205.,9019.,8723.,8617.,8570.,10110.,9439.,9194.,9083.,11820.,10520
6.,10040.,9845.,14120.,12070.,11280.,10930.,17010.,14040.,12910.,12
7370.,20260.,16130.,14920.,14170.,23720.,19160.,17220.,16260.,27390
8.,22070.,19760.,18590.,31160.,5110.,22460.,21090.,34950.,28250.,2
95260.,23710.,38760.,31420.,28138.,26410.,42530.,34610.,31030./
DATAAC/29150.,46280.,37780.,33940.,31900.,49970.,40940.,36830.,346
150.,8526.,8413.,8361.,8331.,8309.,9413.,9108.,9014.,8929.,8671.,10
2940.,10310.,10090.,9902.,9773.,13240.,12170.,11740.,11400.,11170.,
316240.,14700.,13980.,13470.,13100.,19720.,17700.,16730.,16030.,155
420.,23590.,21080.,19870.,18990.,18340.,27630.,24760.,23270.,22220.
5,21440.,31770.,28540.,26840.,25630.,24730.,35980.,32390.,30500.,29
6150.,28140.,40180.,36280.,34200.,32720.,31600.,44480.,40260.,37910
7.,36310.,35090.,48630.,44120.,41610.,39680.,38570.,52720.,47950.,4
85270.,43430.,42030.,56750.,51710.,48880.,46930.,45450./
P=PRES
M=ENTH

```



```

27 N=13
33 FP=(P-BP(N))/DP(N)
IP=FP
IF(IP.GT.MX(N))IP=MX(N)
F=FP-IP
FP=1.0-F
FM=(M-BH(N))/DH(N)
IM=FM
FF=FM-IM
FM=1.0-FF
I=IM*JP(N)+IP*LOC(N)
J=I*JP(N)
EHLFAC=(FP*FM*(I)+F*FH*(I+1)+FP*FF*(J)+F*FF*(J+1))/R
RETURN
END

SUBROUTINE EHLFAC
COMMON/EHLFAC/C(735)
DATA(C(1),I=363,443)=3451.66,4849.4,6188.86,6994.94,7168.69,7104.
109.3791,29.4918,5989.54,6895.8,6982.69,7017.76,7006.89,5834.6,692
22.69,7017.76,4667.14,5721.09,6470.54,6757.48,5115.49,5776.14,6285.
399.6537,88.5368,51.5792,94.6144,19.6344,55.5462,97.5743,82.5987,3.
46150.32,5440.93,5636.73,5821.04,5961.11,5352.98,5504.8,5648.09,576
54.34,5228.49,5344.9,5468.28,5565.41,6083.13,5525.8,5268.48,5036.73
6.4817,54.4597,02.6994,44.6153,8.5896,11.5686,86.6597,81.5359,79.71
799.08,6659.6301,02.6807,42.5929,27.5789,72.6820,36.6731,35.6503,2
87.6312,95.6162,6042.89,6537.08,6621.05,6516.7,6380.12,6255.98,614
98.22,6296.57,6412.18,6398.38,6327.95,6244.16,6161.77,6056.85)
DATA(C(1),I=444,520)=6185.82,6216.64,6197.45,6154.28,6102.33,5813
1.09,5944.09,5996.95,6042.04,6003.13,2980.24,5565.4,5695.4,5729.32
2.5771,31.5793,15.5799,82.5339,79.4789,16.4181,33.3333,5789.72,536
38.27,9986.44,485.7168,82.89,5705.81,5389.54,5050.4,6142.22,5876.54
4.5636,73.5398,7.5161,77.5933,88.5743,18.5569,97.6102,33.5930,31.5
5779.14,5635.93,5980.24,5867.74,5757.56,5647.33,5799.82,5765.13,569
65.57,5614.07,5215.5565,5750.5740,4575.5,4783.5000,5070.4704
7.4,4855.8,5085.5064,5072.85,5148.5225,5264.5361,22.5402,44,
85446.5470,9572.24,5594.66,5614.91,5633.19,5572.24,5678.2,6245.6,
96157.13,6693.96,6633.7178,27.7526,5.7685,7.7965,8.8506,7.8456,8)
DATA(C(1),I=529,617)=6150.7,6317.72,6479.83,6716.9,8028.03,8986.9
1.9496,9371.9570,10972.10305,10364.13238,11700.11510,
216211.13603,13045.19683,15947.14971,23416.16000,17245.
3.8185,8180.8206,41,9026.8789,35,8753.87,10963.9704,8,9454.4,1
44285.11452,10750.19035,14075.12725,24499.17417,15342,3029
59.2127,18438.36165,25255.21812,8228.8196,8181.94,9553.89
626.2,8802.3,11955.10507,10128.16096,13524.12488,21535.17607
7.15098,27295.22519,20149.33341,27749.24788,39544.33024,2
8945.8381,8252.97,8220.39,8204.8,9019.8722,86,8617.0548570.3,10
9187.9439,43.9194,01,9082.97,11816.10516,11004.1,9844.8,14123.)
DATA(C(1),I=618,703)=12069.11279,10928.6,17005.14039,12915.1
12373.5,20257.16427,14917.14167,23724.19164,17223.16260,273
293.22071,13758.10588,7,31161.25115,22457.21091,34954.28248
3.25268,23712.7,38762.31420,28130.26406,7,42535.34609,11028.
4,29147.3,46288.37704,133936.31900,2,49965.44944,34831.34654.1
5,9527.87,843.02,8361.48,8330.58,8309.4,9412.7,9108.2,9014.31,892
69.25,8802.3,10944.10314,10088.3,9902.45,9772.64,13239.12174,1
71736.9,11402.8,11165.7,16243.14696,13977.13665,1.13096,1.19718.
8,17783.16729.9,16031.8,15521.8,23592.21079,19868.18989.9,18341
9.5,27628.2,2761.2,2267.7,22222.21444,31773.28539,26855.2)

```

```

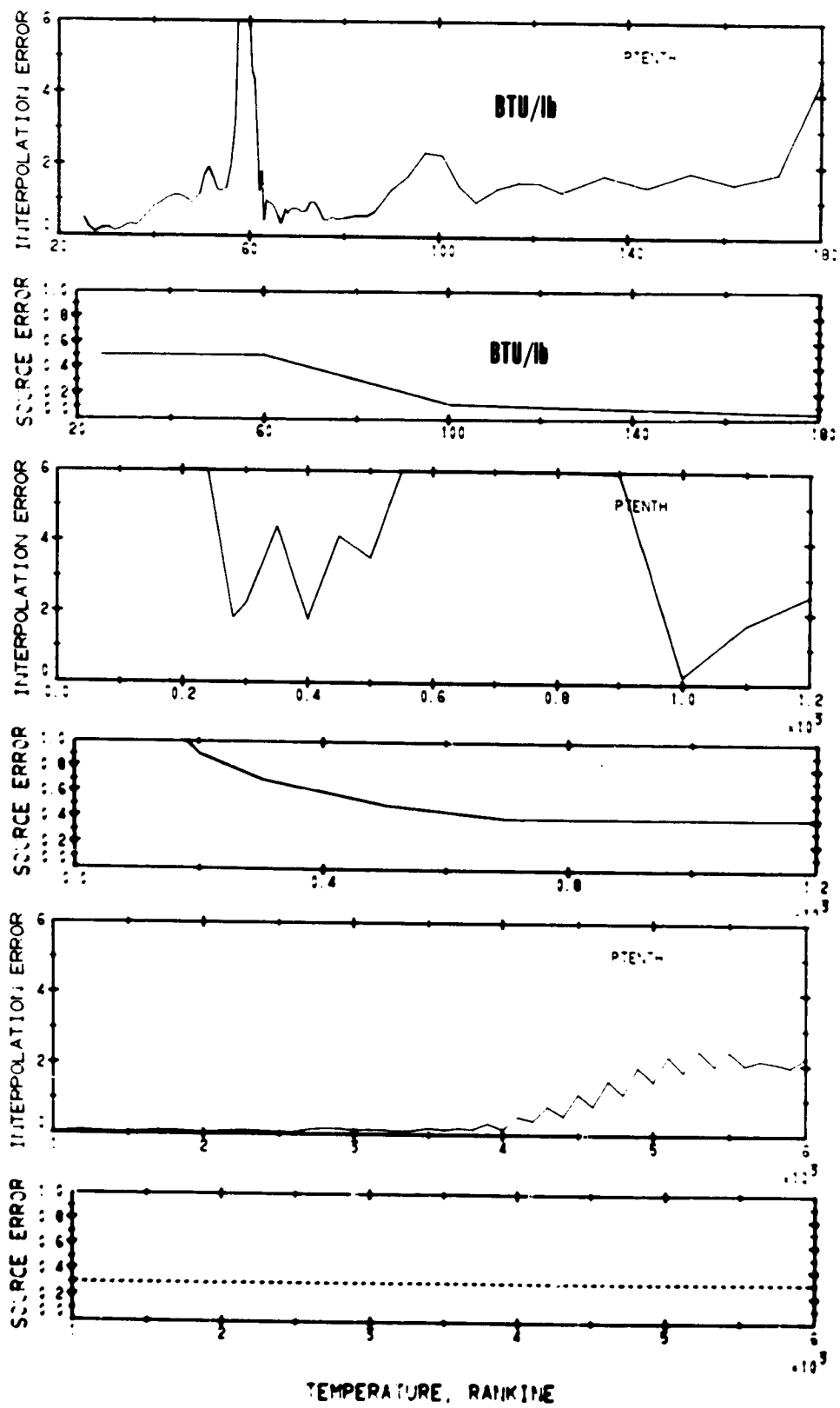
DATA(C(1),I=704,735)=25631.7,24731.5,35976.32392,30496.1,29149.
17,28137.7,40180.36278,34201.7,32718.4,31601.3,44475.9,40260.3,379
213.4,36306.3,35091.5,48630.5,44122.8,41611.3,39881.4,38871.7,52722
3.8,47945.4,45268.9,43426.9,42032.8,56748.9,51708.4,48880.7,46933.7
4,45453.1)
END

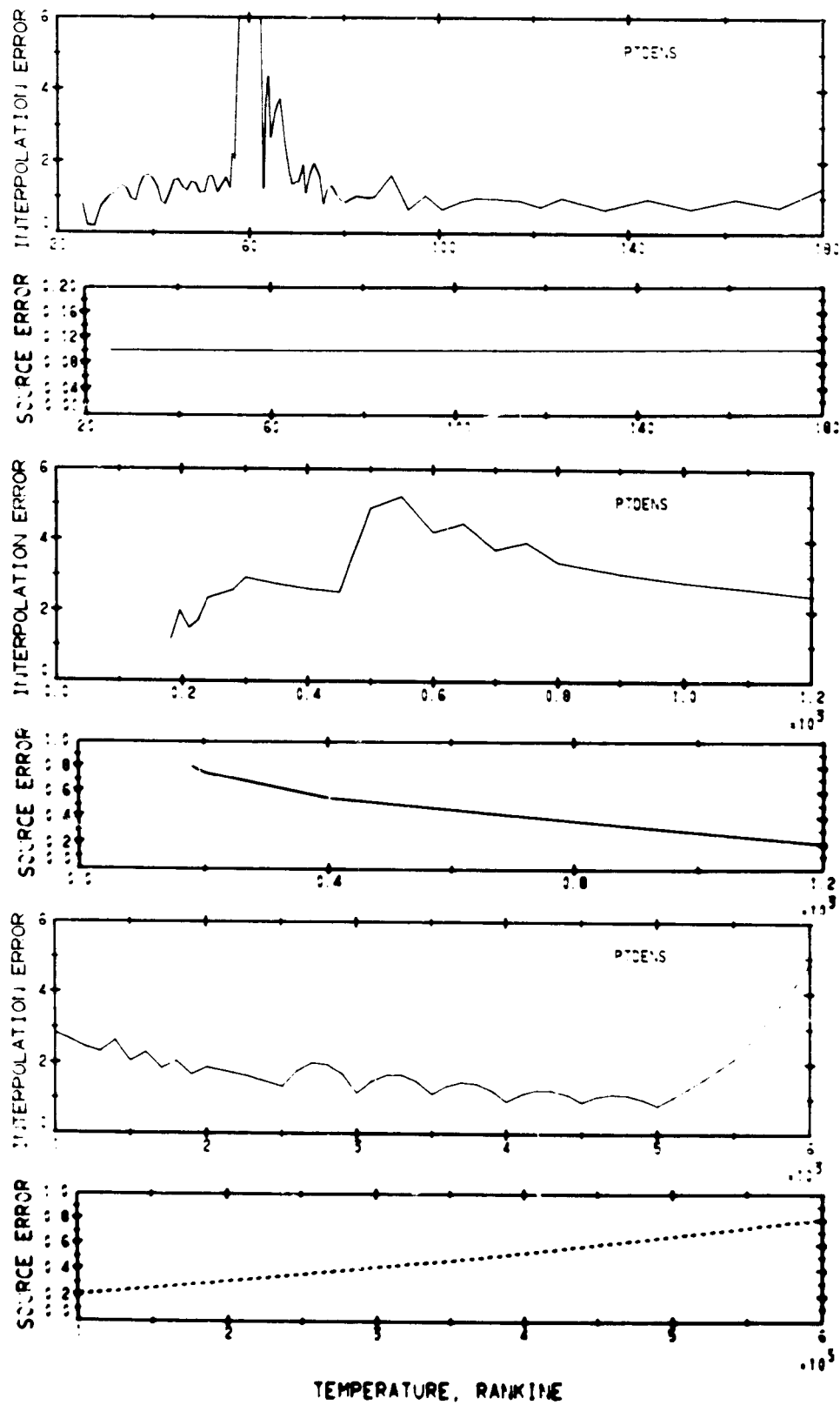
```

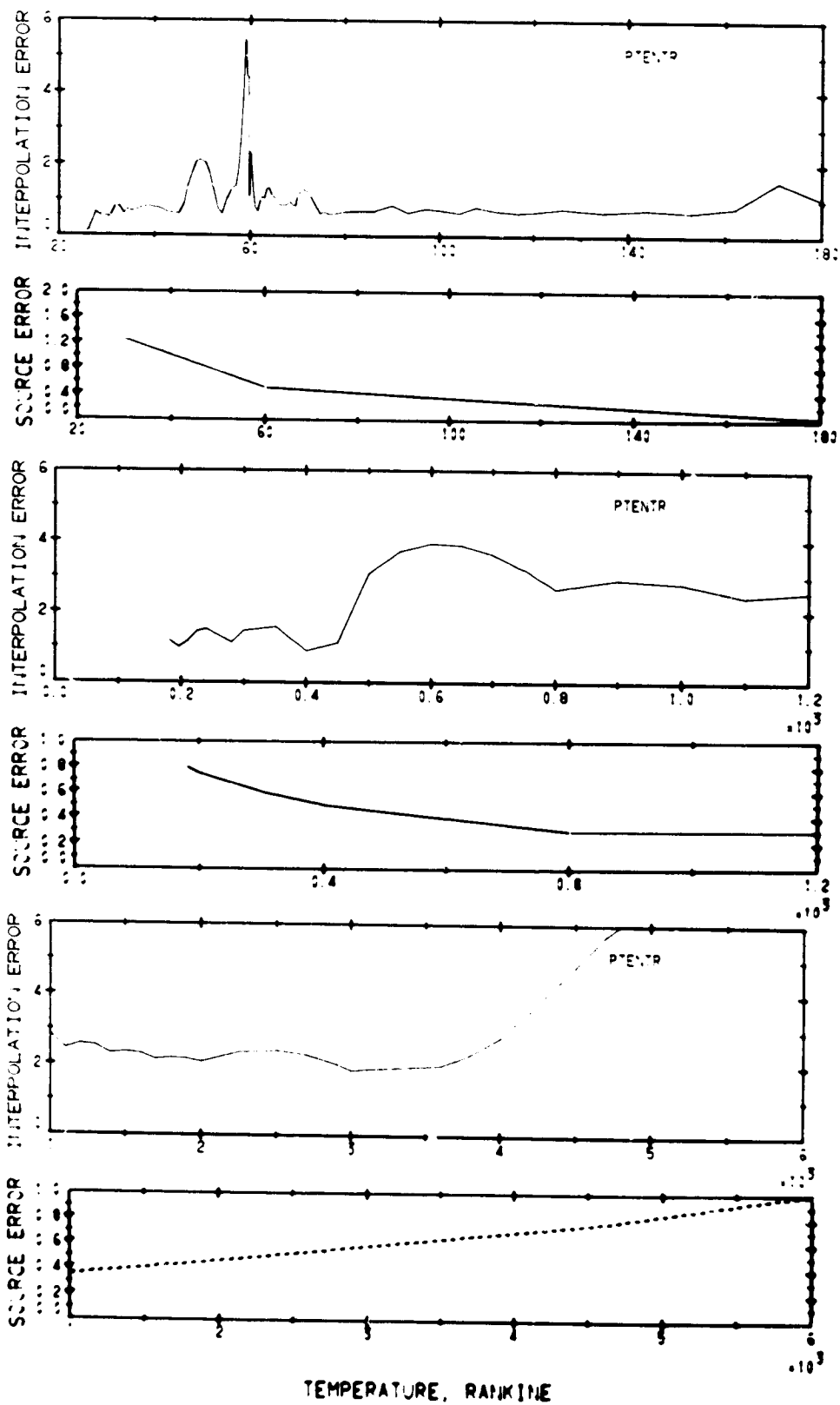
APPENDIX C. PLOTS OF MAXIMUM INTERPOLATION  
ERROR AND ESTIMATED SOURCE ERROR

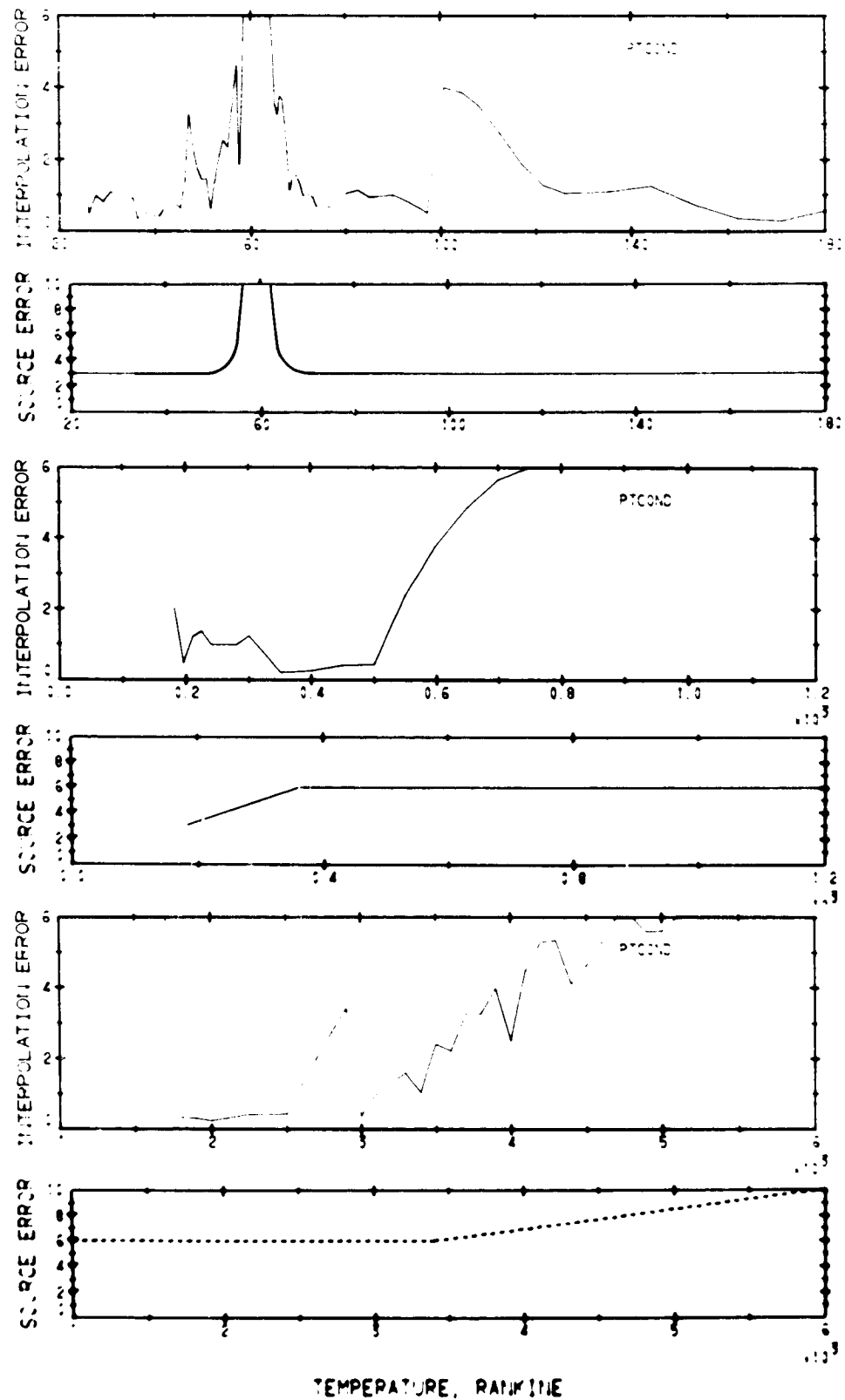
	Page No.
Parahydrogen	
PTENTH	178
PTDENS	179
PTENTR	180
PTCOND	181
PTVISC	182
PTSOUN	183
PTCP	184
PTCV	185
PTGAMM	186
FTLFAC	187
PHTEMP	188
PHDENS	189
PHENTR	190
PHCOND	191
PHVISC	192
PHSOUN	193
PHCP	194
PHCV	195
PHGAMM	196
PHLFAC	197
Equilibrium-hydrogen	
ETENTH	198
ETDENS	199
ETENTR	200
ETCOND	201
ETVISC	202
ETSOUN	203
ETCP	204
ETCV	205
ETGAMM	206
ETLFAC	207
EHTEMP	208
EHDENS	209
EHENTR	210
EHCOND	211
EHVISC	212
EHSOUN	213
EHCP	214
EHCV	215
EHGAMM	216
EHLFAC	217



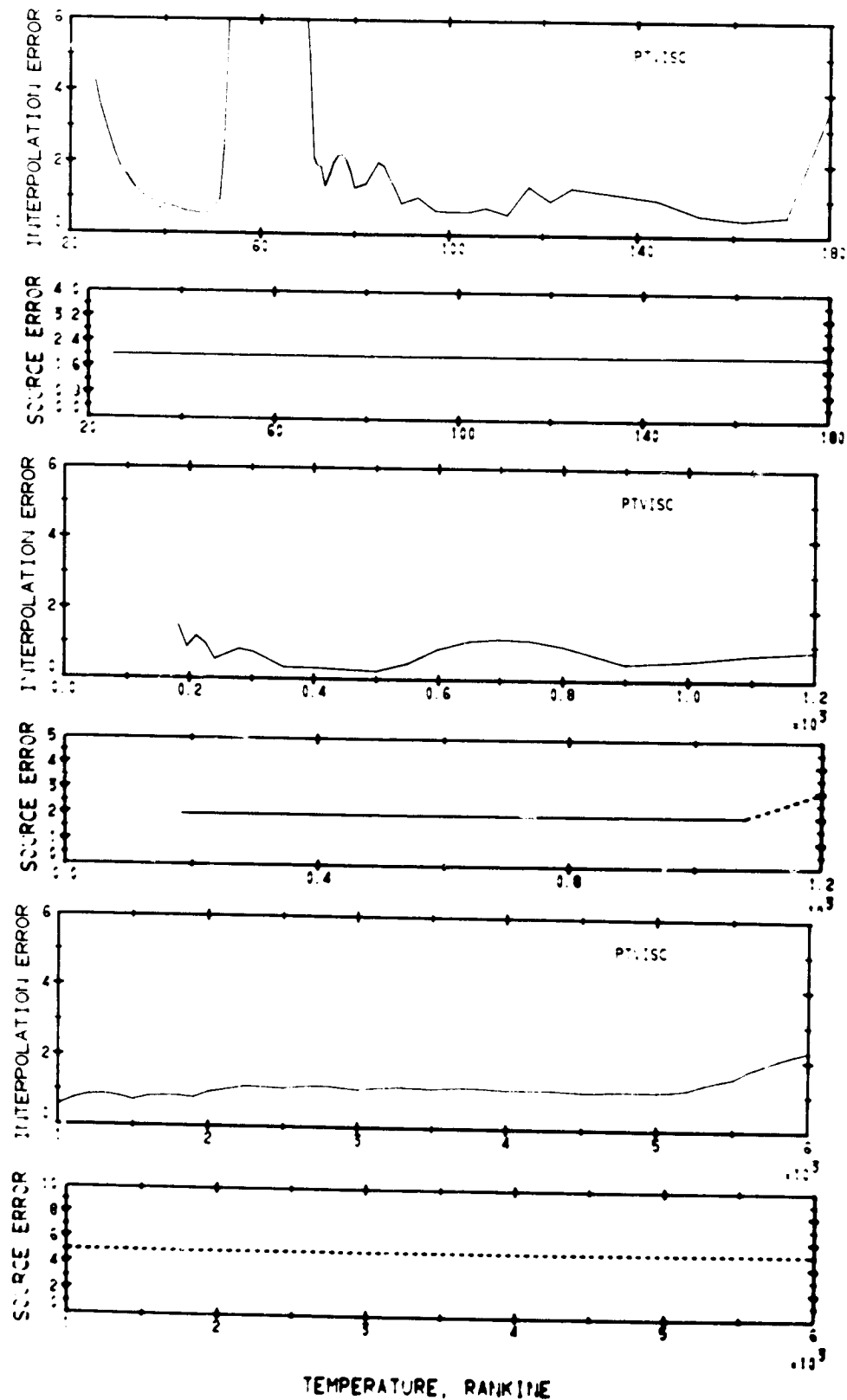


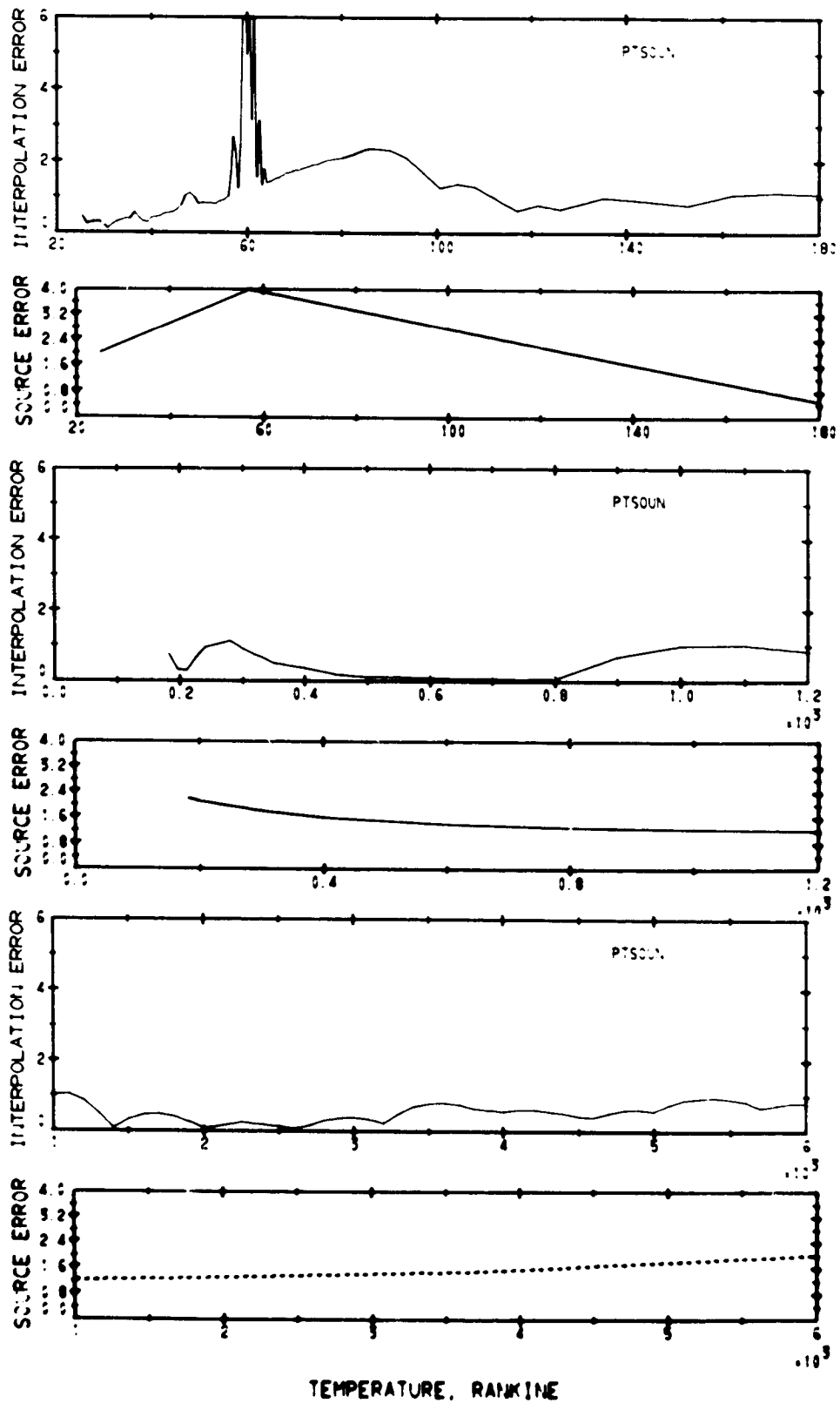




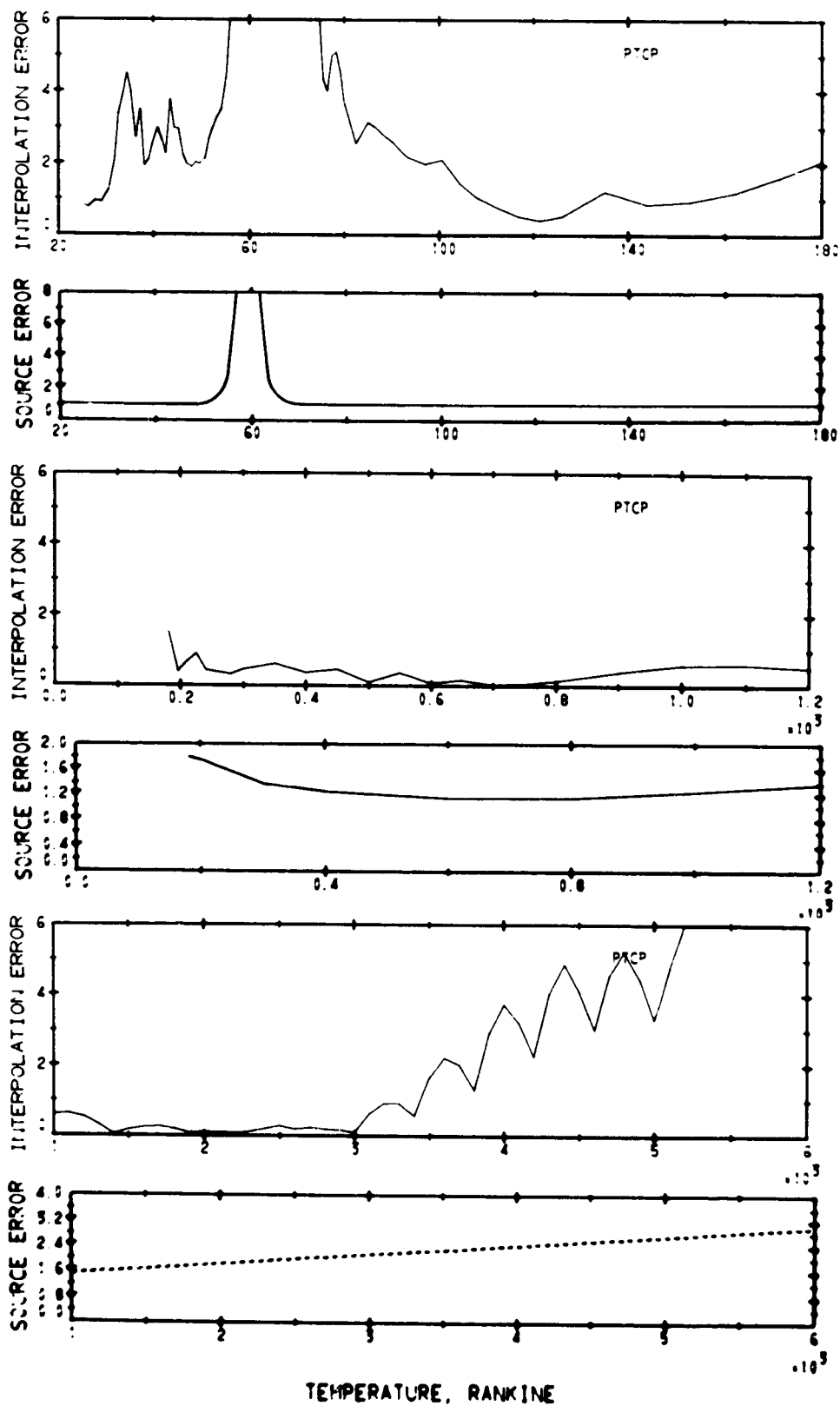


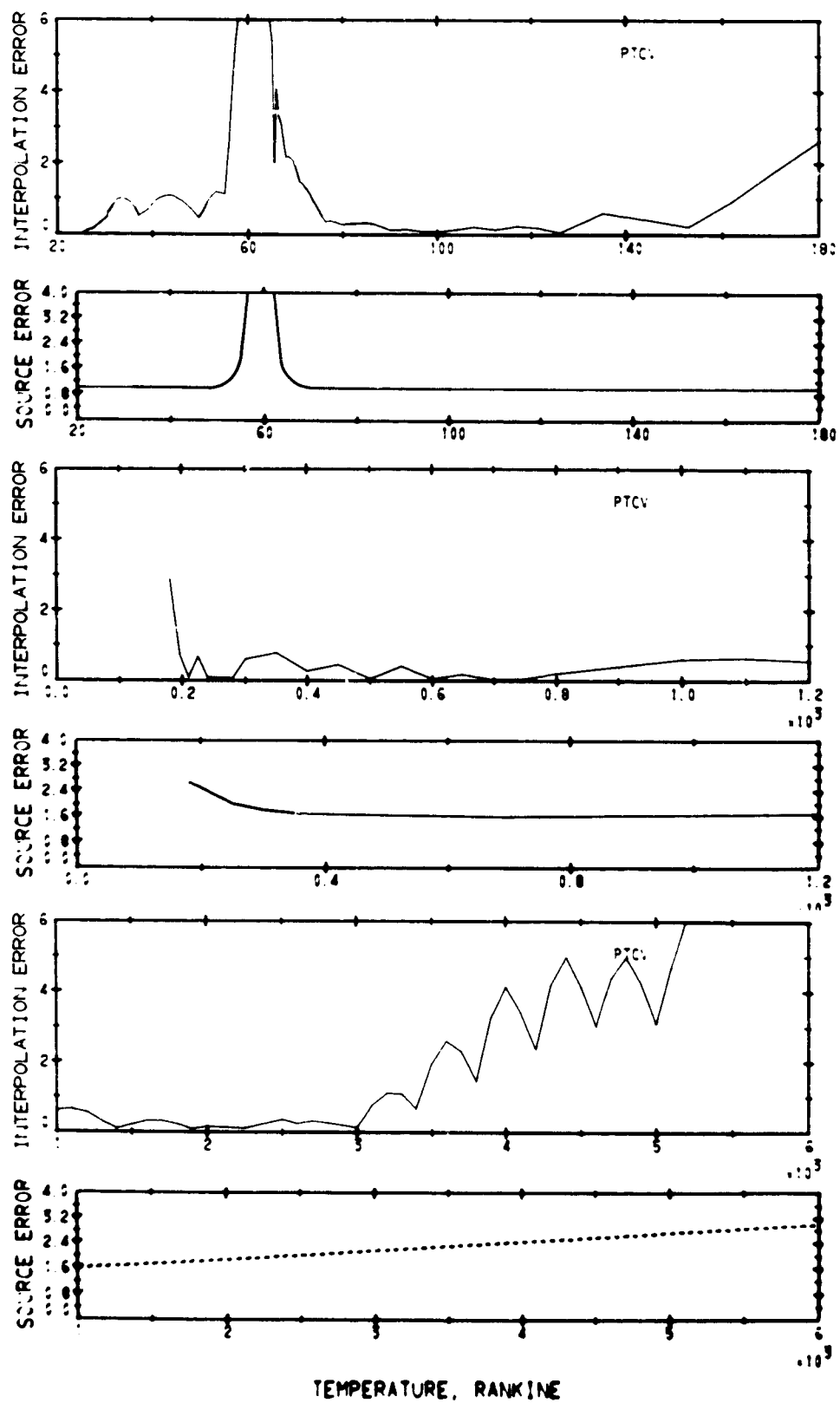
REPRODUCIBILITY OF THE ORIGINAL PAGE IS POOR,



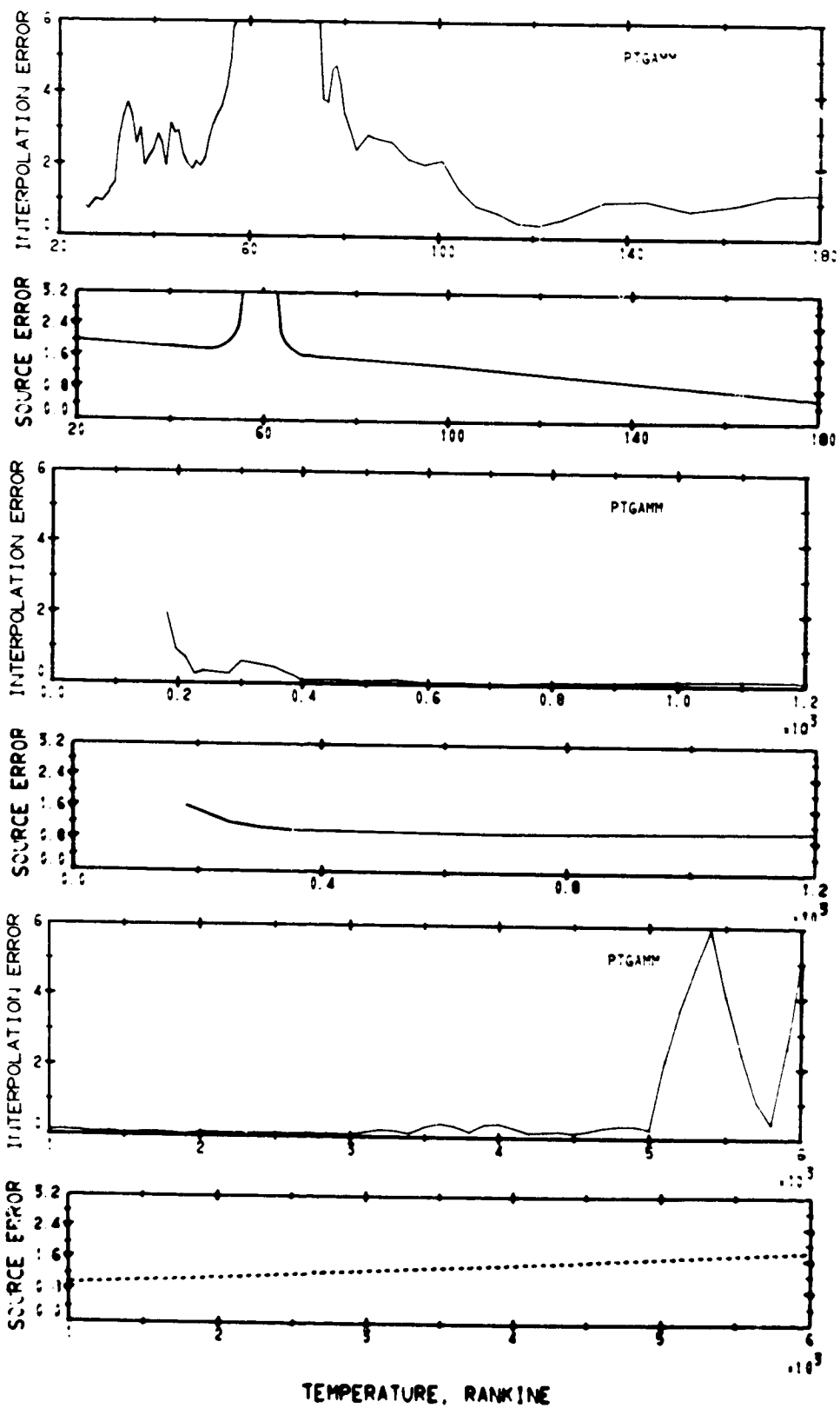


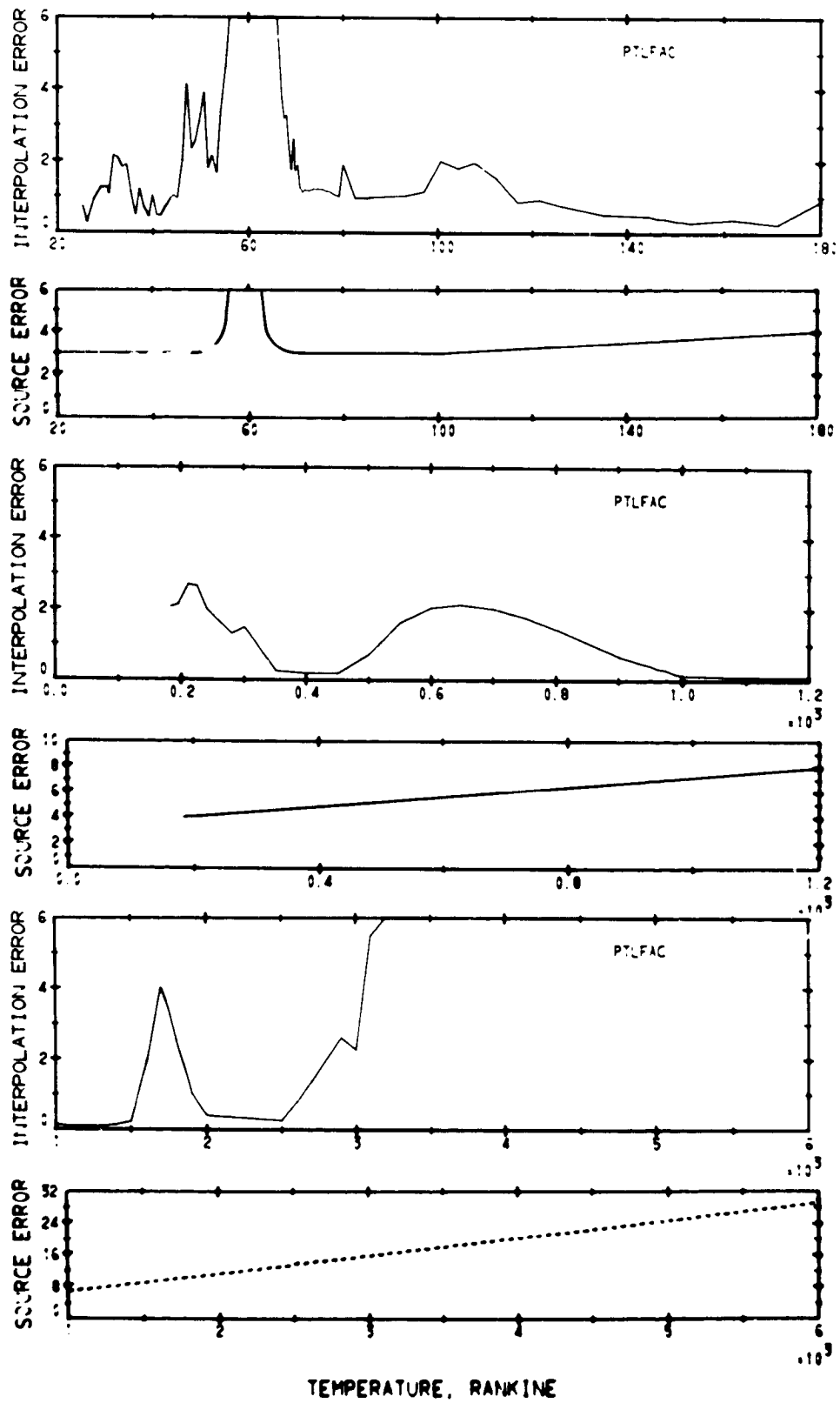
REPRODUCIBILITY OF THE ORIGINAL PAGE IS POOR,

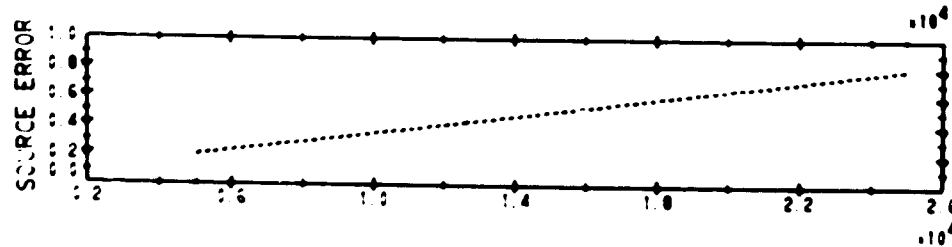
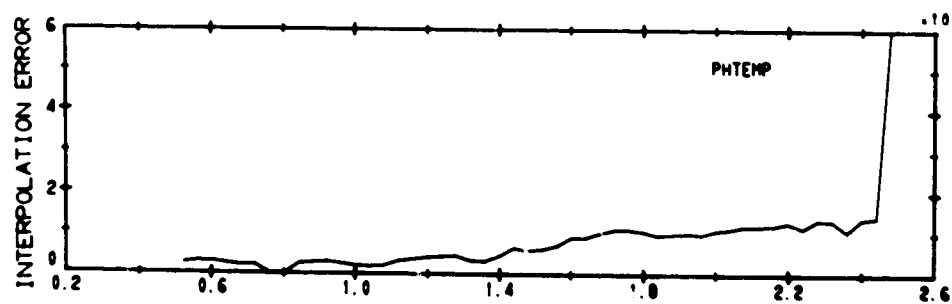
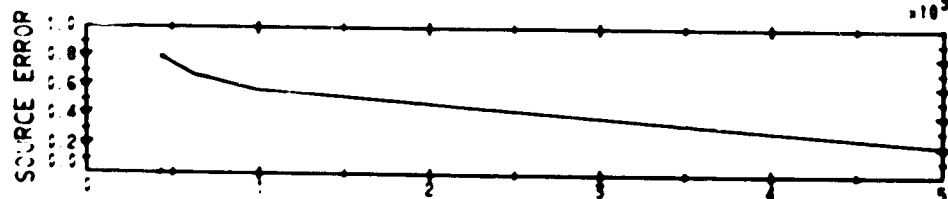
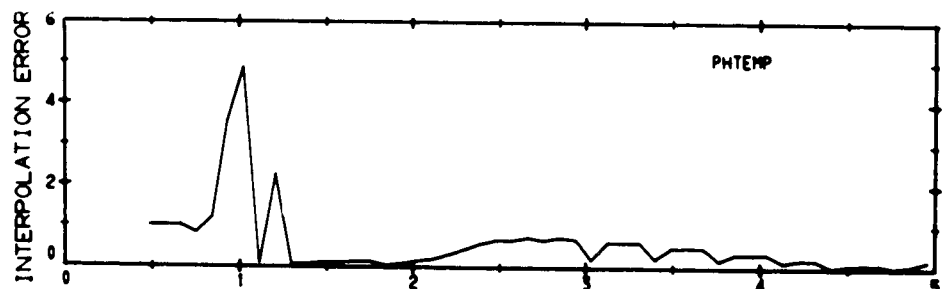
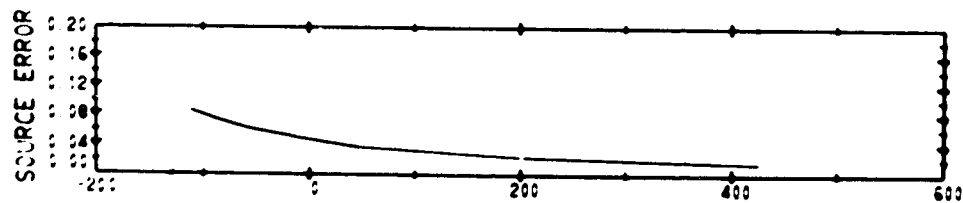
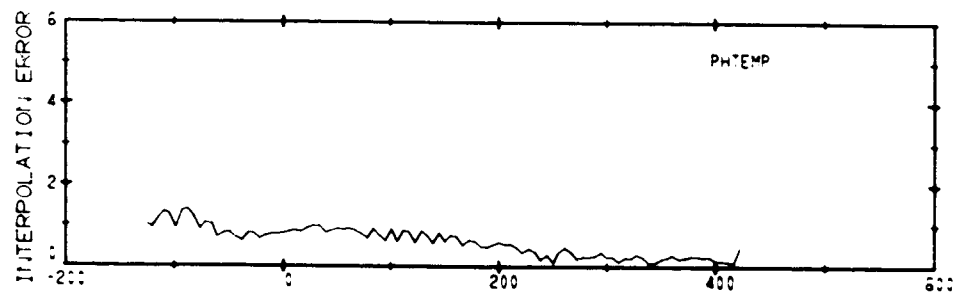




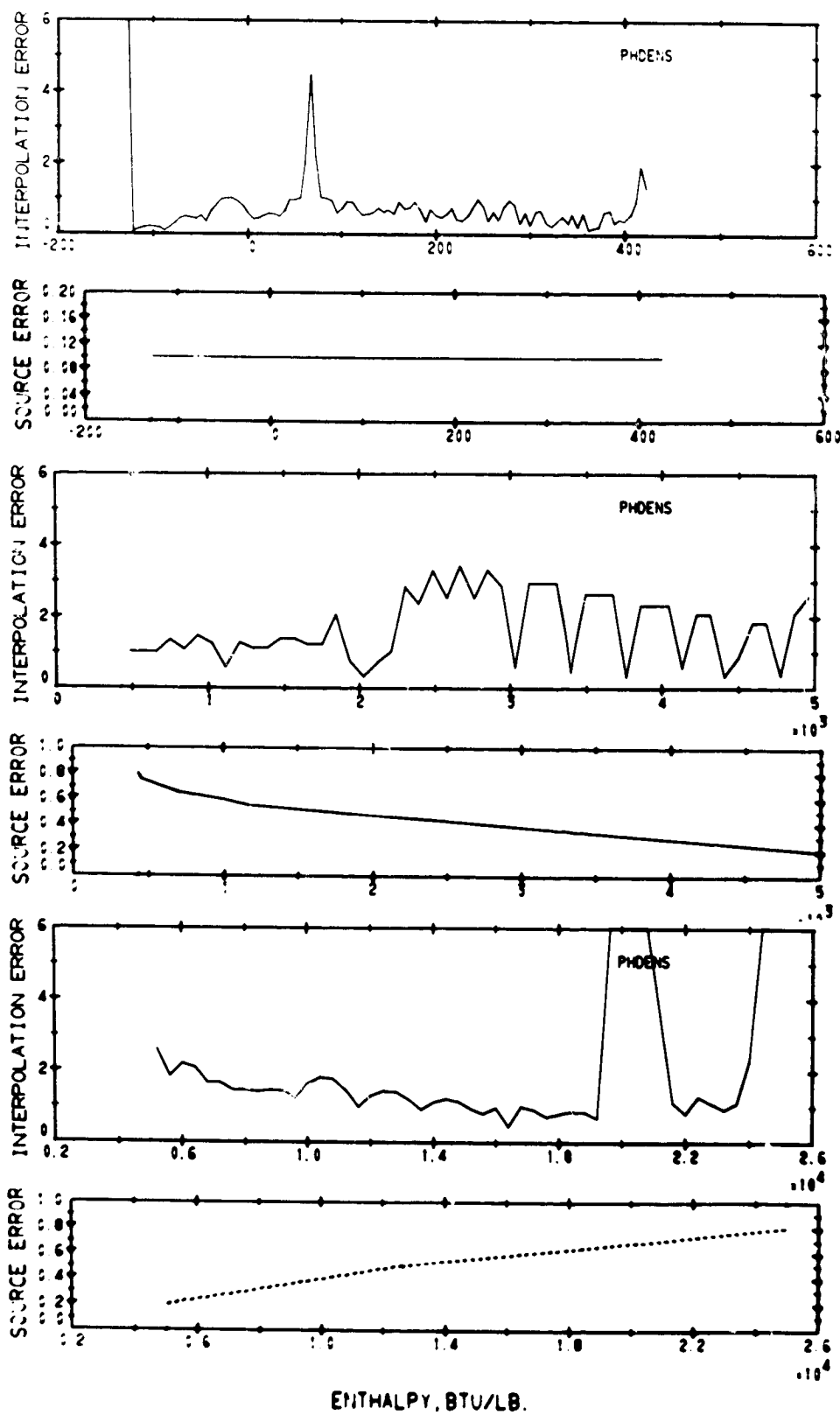


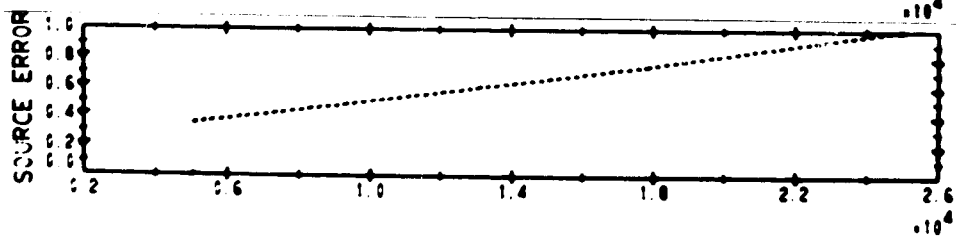
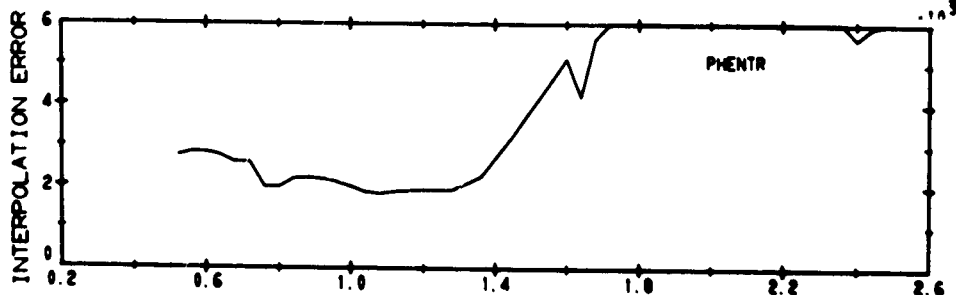
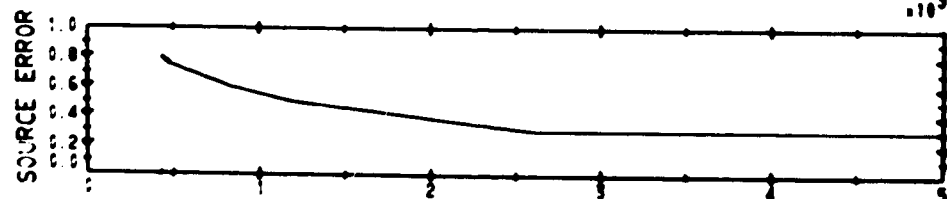
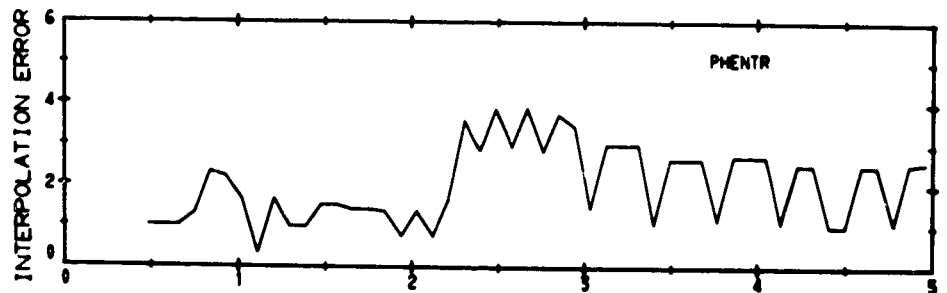
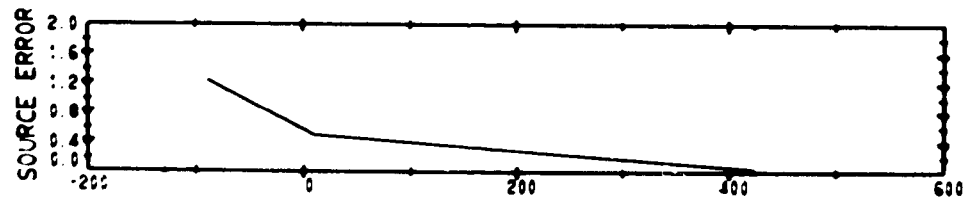
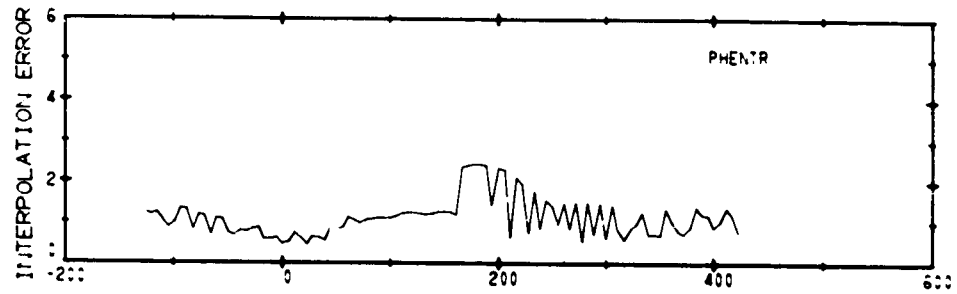






ENTHALPY, BTU/LB.





ENTHALPY, BTU/LB.

